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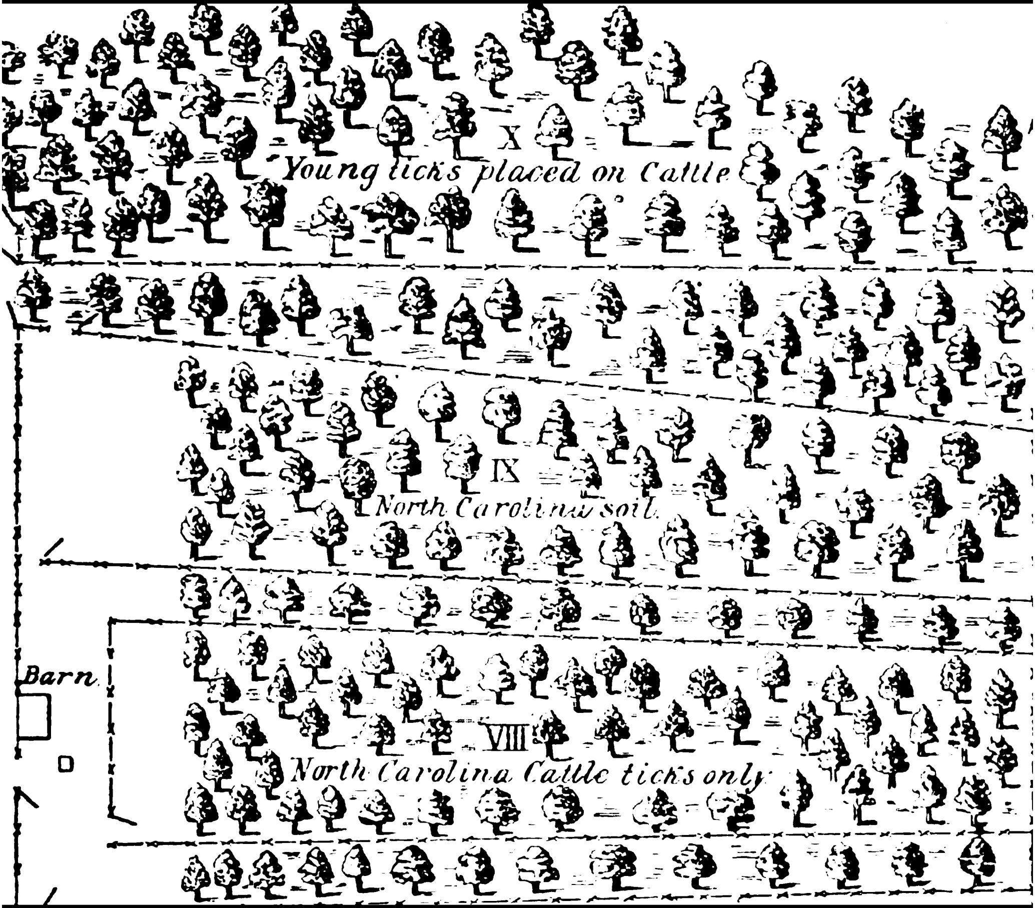
X
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IX
North Carolina soil
Barn
VIII
North Carolina Cattle ticks only

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OF THE

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FOR THE

SECOND SESSION OF THE FIFTY-SECOND CONGRESS.

1892-'93.

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52D CONGRESS, 2d *Session.* } HOUSE OF REPRESENTATIVES. { MIS. DOC. No. 120.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY.

EIGHTH AND NINTH ANNUAL REPORTS

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR

THE YEARS 1891 AND 1892.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

Concurrent resolution to print the annual reports of the Bureau of Animal Industry for the years eighteen hundred and ninety-one and eighteen hundred and ninety-two.

Resolved by the Senate (the House of Representatives concurring), That there be printed 50,000 copies of the Eighth and Ninth Annual Reports of the Bureau of Animal Industry for the years 1891 and 1892, of which 13,000 copies shall be for the use of the members of the Senate, 27,000 copies for the use of the members of the House, and 10,000 copies for the use of the Secretary of Agriculture; the illustrations to be executed under the supervision of the Public Printer in accordance with the directions of the Joint Committee on Printing, the same to be subject to the approval of the Secretary of Agriculture.

Adopted May 10, 1892.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., February 23, 1893.

SIR: I have the honor to submit herewith the Eighth and Ninth Annual Reports of the Bureau of Animal Industry, giving, somewhat in detail, the work accomplished during the years 1891 and 1892. As in two preceding cases, where legislation providing for the printing of these reports failed for lack of time on the part of Congress, the reports for two years have been combined in one volume.

In my former report I alluded to the active measures undertaken for the extirpation of contagious pleuro-pneumonia of cattle. Those measures were continued with great vigor until the last trace of the disease had disappeared, and I am now able to report the complete eradication from this continent of this destructive malady, which had existed among our cattle for a period of half a century.

Since my last report the work of meat inspection, under the act of Congress of March 3, 1891, has been inaugurated, with the gratifying result of the withdrawal by foreign governments of the restrictions against our meat products. With the withdrawal of these restrictions, which weighed heavily upon the animal industries of the nation, the confidence of European governments in the purity and wholesomeness of American meats has been restored, and a guaranty given to our people that the meat products entering into domestic consumption, which bear the inspection mark of this Department, are from animals which are sound, healthy, and fit for human food.

The efforts of the Bureau to regulate the transportation of Southern cattle in order to prevent the spread of Southern cattle fever has not been relaxed, and the value of its thorough system of inspection and disinfection of vehicles of transportation is seen in the greatly diminished number of outbreaks of this disease in the United States, and the reduction of insurance rates on export cattle.

The results of the scientific investigations have been of great value, especially those relating to investigations instituted by the Bureau in regard to the nature and treatment of lumpy-jaw or actinomycosis of cattle, and the nature, causation, and prevention of Southern cattle fever. The account of the investigation of these diseases was issued in the form of special reports, but the discoveries made have been deemed of sufficient importance to warrant a wider circulation by a reproduction of both reports in this volume. A series of experiments with mallein, for the detection of glanders in horses, and tuberculin, for the proper diagnosis of tuberculosis, have been conducted in the biochemic laboratory of the Bureau, and have resulted in discoveries of great value.

In addition to my report proper, several articles that will prove of interest to the general reader may be found, among which might be named an article on the "Condition of the Poultry and Egg Industry," one on "The Mule, its uses, how to breed, grow and prepare for market," "Supposed *Maladie du Coït* among Horses in Nebraska," "Cattle and Sheep Industry of Colorado," "Bottom Disease among Horses in South Dakota," etc.

D. E. SALMON,
Chief of the Bureau of Animal Industry.

Hon. J. M. RUSK,
Secretary of Agriculture.

EIGHTH AND NINTH ANNUAL REPORTS OF THE BUREAU OF ANIMAL INDUSTRY.

REPORT OF THE CHIEF OF THE BUREAU.

TRANSACTIONS OF THE BUREAU FOR 1891.

The work of the Bureau of Animal Industry during the past year has been much more extended and successful than ever before. In the endeavor to place our animals and meats upon the foreign markets in such a condition and with such guarantees that no doubt could be raised in regard to their healthfulness or wholesomeness, a number of new lines of service were instituted.

INSPECTION OF EXPORT CATTLE.

Export cattle have been inspected and marked for identification with a numbered tag in the ear at the first stock yard in which they were admitted. A record of all these cattle has been kept, showing the section of the country from which they came, and the farm upon which they were fed. These cattle were afterward examined at the port of shipment, and a certificate of inspection issued to accompany them. It has been the endeavor to throw around export cattle all possible safeguards against exposure to any form of contagion during their shipment from the interior to the seaboard. Vessels carrying these cattle have been inspected and required to furnish suitable quarters for their transportation in a humane manner and healthful condition. Three American veterinary inspectors were stationed at the principal foreign animal wharves in Great Britain in August, 1890, and it has been the duty of these inspectors to report on the condition of the cattle arriving. In case the British inspectors reported any contagious disease as existing among these cattle, it was the duty of our inspectors to forward full particulars, together with the tag numbers of the suspected animals, so that their history could be traced.

MEAT INSPECTION.

In addition to those measures applying to the shipment of live cattle, an inspection of meats has been inaugurated. Cattle slaughtered for the export or the interstate trade are inspected by a veterinarian before they go into the slaughterhouses, and other veterinary inspectors are stationed upon the killing floors to examine the viscera of each carcass as it is dressed. Every quarter of this beef bears a numbered tag identifying it as inspected meat. In the case of hogs, two or more samples for microscopic inspection are cut from each carcass while it is on its way to the cooling-room. Each carcass is numbered with a printed tag, and a duplicate number is put into a tin box with the samples. These samples are then taken to the rooms where the microscropic inspection is performed, and when examined a report giving the results of the examination is returned to the inspector at the slaughter-house. The carcasses remain in the cooling-room from twenty-four to forty-eight hours before going to the cellars where they are cut and cured, giving ample time for the microscopic inspection to be performed without delaying the operations of the packers. All carcasses found affected with trichinæ are rejected, and only those which have passed a most rigid microscopical examination are allowed to go into the cellars from which the inspected meat is shipped.

In addition to the inspection and quarantine of cattle coming from other countries than North and South America, which has been maintained for a number of years, an inspection has recently been instituted on all animals imported into the United States from the several countries on the American Continent. In some cases it has been necessary to quarantine these animals for a limited period, in order to prevent the introduction of disease.

The inauguration of these different and distinct lines of work has required much time and careful investigation to elaborate the details of the regulations, while the organization of a force for carrying on the work has not been without its difficulties. Considering that a service of this kind had never before been attempted in this country, it must be admitted by everyone that it has been performed more successfully and has caused less delays or embarrassments to the enormous trade which it controls than was anticipated. Some questions of great importance to the country have been made prominent, and are likely to be settled by these inspections.

INSPECTION OF AMERICAN CATTLE AT BRITISH PORTS.

One of the first questions demanding attention was the nature of the disease discovered in the American cattle landed in Great Britain, and which had been pronounced by the British inspectors to be contagious pleuro-pneumonia. There were many facts which for years had led to the suspicion that there must be an error of diagnosis in most if not all of these cases. For example, cattle coming from the interior of the country where pleuro-pneumonia had never existed, and shipped through uninfected districts, were as likely as any to be declared affected with this disease. For more than two years there has been such a small number of outbreaks of pleuro-pneumonia in the United States—and these were confined to districts strictly quarantined—that it did not seem possible that the export animals could be infected. It is gratifying to report that since American inspectors have been stationed in Great Britain—about fifteen months ago—there have been but three cases of contagious pleuro-pneumonia reported by the British inspectors as affecting American cattle. In each of these cases the American inspectors protested against the diagnosis, and reported to this Department, giving the tag numbers of the affected animals. A careful investigation was then made by this Department, and it was found that no disease of a contagious nature had existed on the farms where these animals were fed or in the localities from which they came; that pleuro-pneumonia had never existed in those localities, and that there was no possibility of the animals being infected with this disease in transit. The American inspectors considered the disease to be catarrhal pneumonia, caused by exposure during the voyage. As the cases occurred in March and April, when the weather was cold and stormy, there was good reason to believe their opinion to be correct, especially as the animals had not been exposed to the contagion, and as it is admitted by all that it can only be contracted by exposure to an animal already affected by it.

The British inspectors receded from their position in the case of one of these animals. Specimens from the lungs of the others were submitted to Prof. Williams, principal of the new Veterinary College of Edinburgh, one of the most eminent veterinarians in the profession, who, as well as his son, a professor in the same institution, decided that they were affected with a disease which they designate as *broncho-pneumonia catarrhalis.* This was also the opinion of Prof. J. E. Ryder, of the American Veterinary College, who was in England at the time. Taking the opinion of these distinguished gentlemen, in connection with the history of the animals as established by the investigations of this Department, it became plain that the diagnosis of contagious pleuro-pneumonia, as affecting the animals in question, could not be successfully maintained. The inspectors of the British agricultural department were unwilling, however, to concur in this conclusion.

In June, 1891, an editorial article on this subject appeared in the Journal of Comparative Pathology and Therapuetics, which is edited by Prof. McFadyean, one of the inspectors of the British agricultural department. This article states the conditions under which cattle from the United States are landed and slaughtered in Great Britain, and gives a brief summary of the difference of opinion as to the nature of the lung disease which has occasionally been found among them. It goes on to say that two possible explanations of this state of affairs suggest themselves. First, that pleuro-pneumonia might exist in the United States in districts regarded as free from the disease; or, second, that the British veterinary inspectors made a mistake in diagnosis. Referring to the two cases discovered in April, 1891, about which there was a difference of opinion, it says that they were found after slaughter to present lesions which the British veterinary inspectors considered to be those of contagious pleuro-pneumonia. The correctness of this diagnosis was confirmed by the veterinary advisers of the board of agriculture in London, but Veterinary Inspector Wray, the American inspector stationed at London, disputed the accuracy of the diagnosis, and maintained that the lesions in question were not those of pleuro-pneumonia. Portions of the diseased lung from one of these animals were submitted to Profs. Walley and McFadyean, and their opinion was in consonance with that of the home authorities. After mentioning that specimens from these lungs had also been submitted by Dr. Wray to Prof. Williams, and the opinion of the latter, the article says:

> It has, we believe, been generally held in this country that the post-mortem diagnosis of contagious pleuro-pneumonia is not a matter of great difficulty to anyone who has had much experience of the disease; that, in fact, an identical pathological picture is never met with in any other affection; and it is hardly possible to conceive an explanation of the flagrant difference of opinion that has arisen regarding the present case. If Prof. Brown and his assistants at the board of agriculture do not know pleuro-pneumonia when they see it, it can not be from lack of experience; and since the American inspectors were stationed in this country in order to control the diagnosis of the British inspectors, it must be concluded that they were selected from those who had had abundant opportunity to make themselves acquainted with the pathology of pleuro-pneumonia. It is within the range of possibility that on American soil there exist other bovine diseases having lesions not distinguishable

from those of contagious pleuro-pneumonia, and something to this effect was said not long ago by Dr. Salmon, the veterinary adviser to the United States Government.

* * * * * * *

We need hardly say that we do not quote this passage in order to show what are Dr. Salmon's views regarding the morbid anatomy of pleuro-pneumonia, for if he had any intention of explaining how his subordinates sent over to Great Britain were to distinguish pleuro-pneumonia from other diseases with which British veterinary surgeons had confounded it, his effort was singularly unsuccessful. One thing is made clear, however, namely, that Dr. Salmon considers it difficult to diagnose a case of pleuro-pneumonia unless the history of the animal is known, and this, of course, must refer to post-mortem diagnosis.

We do not share that opinion, and we do not find in the action of Dr. Wray any evidence that he shares it. Be it observed, Dr. Wray did not say with reference to the lungs of the Deptford cattle, "these lesions resemble those of pleuro-pneumonia, but they may be due to something else, and unless you know the history of the animals, you have no right to pronounce the disease pleuro-pneumonia;" on the contrary, he appears to have experienced no difficulty in deciding that the lesions were *not* those of pleuro-pneumonia.

In other words, Dr. Wray carries in his mind's eye a picture of what he takes to be the lesions of a pleuro-pneumonic lung and he did not find it in this case. In the same way Prof. Brown, Mr. Cope, and the other veterinary officers of the board of agriculture also carry with them a mental picture of the appearances of such a lung, and that picture is different from Dr. Wray's. Both can not be right, and until the American authorities condescend to define these other diseases, vaguely alluded to by Dr. Salmon as having lesions analogous to contagious pleuro-pneumonia, they can hardly expect that when British veterinary inspectors in this country encounter in American cattle "the condition of lungs which resembles pleuro-pneumonia, but which also resembles other diseases," they will pass it over because it may not have been pleuro-pneumonia. In short, if there is a doubt, and probably there was none in this case, home interests must get the benefit of it.

This article was evidently written by a veterinarian, and the writer should, consequently, know that whereas it is sometimes difficult to diagnose contagious pleuro-pneumonia, there are other diseases of the lungs which may be diagnosed with great certainty. For this reason, there is no inconsistency between the position adopted by the chief of this Bureau as to the difficulty of diagnosing isolated cases of pleuro-pneumonia when no history of the case is known, and the position so positively assumed by Dr. Wray, that the two animals in question were affected with broncho-pneumonia, and not with contagious pleuro-pneumonia.. Between these two diseases there is no doubt some superficial resemblance, but those who have given careful study to the question are usually able to diagnose broncho-pneumonia without hesitation. In any case an animal can not have pleuro-pneumonia unless it has been exposed to the contagion of that disease, and, conversely, if it has not been so exposed it can not have that disease. One of the most important reasons for stationing inspectors in Great Britain was to have an official record of each individual animal from the time it left the farm in this country until it reached the docks abroad. And by means of this record it has been positively shown that the animals condemned by the British inspectors had not been exposed, and consequently could not have been affected with pleuro-pneumonia.

In October, 1891, there appeared in the Veterinary Journal and Annals of Comparative Pathology, published in London and edited by Dr. George Fleming, an editorial so ably prepared and withal so free from bias that it is quoted in full as a most valuable contribution for the elucidation of this question.

CONTAGIOUS PLEURO-PNEUMONIA AND INFECTIOUS BRONCHO-PNEUMONIA OF BOVINES.

It is now some years since a diversity of opinion occurred with regard to the presence of contagious pleuro-pneumonia in a cargo of American cattle disembarked at Liverpool, and which were condemned because one of them was found to be affected—

according to the Government authorities—with that disease; but which, in the opinion of Prof. Williams, after inspection of the lung lesions, was not that malady, but another. Quite recently a similar case occurred among another cargo of American cattle, and the same veterinary authorities stood in the same position with regard to its nature, this time Prof. Williams being supported by the United States veterinary inspector, who has been sent to this country by his Government to see that the cattle imported from the States are not unfairly condemned. This course was deemed necessary from the fact that many cargoes arriving from that country have been accused of being infected with the lung plague, which the veterinarians on the other side of the Atlantic have declared it could not be. The recent case just referred to has caused a more than usual amount of interest from the striking difference in opinion as to the nature of the changes in the lungs of the diseased animal; in fact, as to whether these alterations were those of lung plague or another affection. Not long ago we were shown photomicrographs of *pleuro-pneumonia contagiosa* and this American cattle disease which Williams has designated *broncho-pneumonia catarrhalis*, and certainly the difference in appearance between the two is very marked.

This divergency in opinion as to the nature of the malady for which shiploads of American cattle have been condemned has had no result other than that the opinion of the English Government experts has prevailed, and nothing further has been done to settle the matter, though astonishment may be expressed that experimental proof, so easily obtained, was not resorted to.

Strange to say, corroborative evidence in favor of Williams' contention has sprung up in a very unexpected quarter, and on the statement of one of the foremost veterinary pathologists in Europe, who probably knew nothing of what was taking place in England in reference to this matter.

At the meeting of the Central Veterinary Society of Paris, on July 23, Prof. Nocard, of the Alfort Veterinary School, brought forward the subject of "An infectious broncho-pneumonia in American cattle," and to this subject, seeing its great importance, we will devote some attention. It appears from Nocard's statements, that during last winter, at La Villette, the Parisian cattle market, several thousands of fine American cattle from the United States, chiefly from Virginia, Indiana, and Illinois, were exposed for sale, and on three different occasions the sanitary officers of the market observed that some of these animals were affected with an unusual disease of the respiratory organs. These officers—Redon, Godbille, and Blier—are well-known veterinary surgeons, and it was in their name as well as his own that Nocard addressed the meeting. In November last, in a lot of more than 400 cattle direct from Illinois and Indiana, one died and two were very ill, the symptoms leading to the suspicion that they were affected with contagious pleuro-pneumonia. The two ailing animals were at once killed and an examination of their lungs was made by Godbille. There was no pleurisy, but the interlobular septa of hepatized portions was the seat of a very abundant serous infiltration. Before arriving at any decision as to the nature of the malady, and in view of the serious importance of the case from the number and value of the animals, the two sets of lungs were sent to Alfort to be submitted to Nocard. He reports that at the first glance a section of the hepatized tissue presented the appearance of a recent lesion of contagious pleuro-pneumonia. The tissue was dense, compact, friable, and the color varied from bright red and deep brown to almost black, while the lobules were isolated from one another by thick septa, infiltrated with a considerable quantity of yellow limpid serosity. But a closer examination showed that there were notable differences between these lesions and those of lung plague. The connective-tissue infiltration was less abundant and the serum less albuminous and not so yellow or limpid, and here and there pressure on the excessively distended lymphatic sacs extruded small, white, smooth, and firm fibrinous concretions. The tissue of the lobule in the greatly thickened girdle of connective tissue had not the uniformity of tint and consistence that characterizes the pleuro-pneumonic lesion. It was harder, more manifestly hepatized in its center than at its periphery. *The lesion proceeded from the bronchule, and not from the perilobular tissue.* In pleuro-pneumonia it is the opposite; for in it, when the lesion is very recent, lobules are often found, the tissue of which is dense and dark at the periphery, while in the center it is yet rosy, elastic, and permeable. There was another important differential sign. Pressure caused a notable quantity of thick, viscid, light yellow pus, analogous to that observed in certain forms of verminous broncho-pneumonia, to issue from the bronchules, but a microscopical examination of this fluid and of the lung pulp did not lead to the detection of ova, embryos, or worms of any kind. The bronchial mucous membrane was inflamed, thickened, and corrugated, and more or less denuded of its epithelium, while the submucous connective tissue was infiltrated with yellow serum and considerably thickened in places.

This muco-pus from the bronchules was found to contain an abundance of short, oval, motile bacteria, which appeared to be the only microbes present. The organisms were also found, as if in a state of pure culture, in the hepatized tissue, and more especially in the limpid serosity that distended the perilobular lymphatic sacs. This single character alone sufficed to affirm that the lesion was not of a pleuropneumonic kind; for it is well known that the lung serum in that disease is very poor in figured elements, and that when it is collected pure from the infiltrated septa it does not usually contain any microbes.

In this instance the microbe which existed in such numbers in pulmonary lesions belonged to the large class of ovoid bacteria, of which the rounded poles fix anilinated coloring matters more strongly than the center.

Nocard points out that fowl cholera, duck cholera, the septicæmia of rabbits and the ferret, the game plague (the *Wildseuche* of the Germans), the *barbone* of the buffalo, pneumo-enteritis of the pig, etc., all have analogous microbes, which can only be distinguished from each other by their collective biological characters, and more especially by the effects of their inoculation on different kinds of animals.

After describing this microbe in detail, and its cultivation, Nocard refers to the results of inoculation with it. These results were always the same—muco-pus in the bronchia and serosity in the pulmonary connective-tissue septa, whether the cultures were old or new. Mice, rabbits, guinea-pigs, and pigeons, when inoculated subcutaneously with two or three drops of the serum or the culture, succumbed in less than forty-eight hours, without œdema at the point of inoculation, with intense congestion of all the viscera, but without any definite localization. The blood examined soon after death did not show many bacteria, but they increased the longer the interval that elapsed, and especially if the pipettes containing the pure blood were left on the stove for a few hours. When the fluid was injected into the peritoneum, death resulted in fifteen to eighteen hours, with a purulent peritonitis of great intensity; the pus was very abundant, viscid, and not fibrinous, and contained an enormous quantity of bacteria.

Sheep and calves, inoculated subcutaneously or in the trachea, with a cubic centimeter of culture, of serosity, or of virulent pus, did not die; they suffered, however, from intense fever, and remained prostrate, without appetite, for some days, but soon regained their normal condition.

Intrapulmonary inoculation was more effective; as a calf of 8 months and a ram of 2 years, inoculated in the right lung with five drops of peritoneal pus from a guinea-pig, died in less than forty-eight hours with fibrinous pleurisy and exudative broncho-pneumonia analogous to that observed at the autopsy of the American cattle; the lesions were extremely rich in bacteria.

A curious fact was elicited in these interesting experiments. A calf and two sheep, previously inoculated subcutaneously, then in the trachea, afterwards resisted the effects of intrapulmonary inoculation with ten drops of virulent culture; their temperature remained for three days above 40.5° C., there was great sensibility of the thoracic parietes and dullness in the inferior two-thirds of the inoculated lung; but all the morbid symptons disappeared promptly, and subsequently they have undergone two other intrapulmonary inoculations of serum and culture fluid, without any apparent trouble. It would, therefore, seem that, though subcutaneous inoculations will not kill large animals, it will confer such a degree of immunity as will enable them to resist a pulmonary, and otherwise fatal inoculation. The pig, fowl, dog, and rat resisted all modes of inoculation.

Nocard arrives at the conclusion that the disease does not resemble any known in France, and he considers it probable that it is a malady special to American cattle; and that it is not rare is proved by the fact that since the month of November he has seen it —always presenting the same features—in other lots of cattle from the United States—Indiana or Illinois. He is inclined to think that it is the affection which is known in the Western States as the "cornstalk disease;" but however this may be, it results from his observations and investigations that American cattle are liable to a microbic broncho-pneumonia, hitherto unknown in France; and the serious question, therefore, arose as to whether there was any danger to be apprehended from the importation of such animals, a question put to Nocard by the French agricultural administration. From his attentive observation of facts, and the experimental study of the conditions of contagion, he concluded that the malady had only very feeble contagious properties. In the three very large importations in which the disease was detected, notwithstanding the considerable number of animals in each, and their long and close contact with each other, the affection did not spread, and the cases remained isolated ones. From all these facts, his opinion was that there was no urgent danger or any necessity for special measures.

The question that now arises on this side of the channel is one of some moment, not only from an economical, but also from a pathological point of view. Many cargoes of American cattle have been condemned because it was found that one or two in each lot were affected with what was supposed to be the specific and only too-well-known lung plague. United States veterinary surgeons have strenuously denied the existence of that malady among the cattle, and Prof. Williams, on two occasions when the matter has been referred to him, has concluded that lung plague was not present, but that the lesions were those of catarrhal broncho-pneumonia; and now Nocard finds what we are almost forced to conclude is the same disorder, examines it and experiments with it as a scientist of his position and responsibility should do, and, *mirabile dictu*, arrives at the same conclusion as Williams, and even designates it by the same name. It will be an extraordinary revelation if what has been considered as contagious pleuro-pneumonia in American cattle should turn out to be something very different, and of little, if any, importance. The slaughter mania is a terrible barrier to pathological observation; and little as we have done in this country in the way of scientific investigation of animal diseases, it is to be hoped that the example of France in this instance will not be without effect. It is quite possible that the American cattle found in La Villette market would have been condemned here as infected with contagious pleuro-pneumonia, and the usual consequences would inevitably follow. Must we again say that in this instance, as in so many others, "They manage these affairs better in France!"

PROTECTIVE REGULATIONS.

The United States is now practically free from contagious pleuro-pneumonia. During the last seven months no case has been found on Long Island or in any part of the State of New York. The only cases discovered during this time have been in a few small herds of dairy cattle in a very small district of New Jersey. This district is under the most rigid quarantine regulations, and every diseased and exposed animal has been slaughtered immediately after its discovery.

As there is no other disease among American cattle which is liable to be communicated to the animals of other countries, the time has come for a consideration of the regulations enforced by Great Britain and its dependencies in regard to animals from the United States, and those enforced by the United States in regard to animals from these countries. That there is considerable pleuro-pneumonia in widely separated sections of Great Britain, and that this disease has during the past year affected some of the most valuable herds of cattle in that country, is freely admitted. There is, consequently, much more danger of the disease being conveyed to this country by imported animals than there is of its being conveyed from the United States to either Canada or Great Britain.

There is no longer any reason why regulations should not be adopted by the United States for the protection of its live-stock interests as rigid as those which are enforced by the countries just mentioned. This country has been very lenient in the matter up to the present time, and has made regulations which would not interfere materially with the importation of animals, although it has been believed that they were sufficient to prevent the introduction of disease. There is, however, some doubt as to whether a quarantine of three months' duration is sufficient to absolutely guard against the introduction of pleuro-pneumonia when this disease exists in countries from which animals are imported.

Great Britain holds that such a quarantine is not sufficient, and consequently all cattle from the United States are slaughtered upon the docks where landed, within ten days after their arrival. This regulation goes still further and includes sheep and swine as well as cattle.

The Dominion of Canada also enforces a quarantine of three months on all cattle imported into that country from the United States.

If a quarantine of three months is not sufficient to prevent the introduction of pleuro-pneumonia, then we have not only been endangering our stock by allowing importations upon such conditions from Great Britain, but the Dominion of Canada has permitted its stock to be exposed to the same danger, and her cattle for this reason must be dangerous to the cattle of the United States when they are imported into this country.

There are also the same diseases of sheep and swine existing in Great Britain and Canada as exist in the United States, and there is the same danger of bringing such disease here with those animals that there is of introducing them into Great Britain and Canada with the same species of animals from the United States.

To give our stock owners the same protection, therefore, which Great Britain insists is necessary to prevent the introduction of disease into that country, we should establish regulations requiring that all cattle, sheep, and swine imported from Great Britain and Canada should be slaughtered at the ports of entry within ten days.

While our experience in the past has not, in my opinion, made it necessary to suggest such stringent regulations as a sanitary measure, it would seem that our breeders should have the same protection as is enforced by other nations against this country.

PORK INSPECTION.

Since the removal of the prohibition on American pork by Germany, on September 3, 1891, there have been frequent newspaper articles published in that country containing the most absurd statements criticising the work of inspection and disparaging the quality of our meats. It was said that there were but two or three inspectors at a great packing center like Chicago or Kansas City, and that the hogs were cut into pieces at the time of slaughter, so that it was impossible to identify these after the specimens had been examined microscopically. As is stated elsewhere in this report, the carcasses are not cut until from twenty-four to forty-eight hours after slaughter, so that there is ample time for microscopic inspection and for the rejection of all carcasses found to contain trichinæ. There are also a sufficient number of inspectors and microscopists employed to inspect the pork in as rigid and careful a manner as such inspection is carried on in any part of the world. A system of reëxamination has also been adopted by which the work is controlled, and by which if any errors were committed they could be readily detected.

At the time the prohibition was removed, and on account of an imperfect understanding of the conditions under which pork would be received into Germany, a considerable number of shipments were made by various dealers, which had not been inspected, and which were not accompanied by the certificates of this Department. Some of this pork appears to have been admitted and sold on consular certificates, and there is no doubt that some of the criticism directed against our inspection was based upon an examination of this meat.

The following articles, translated from the Frankfurter Zeitung, and forwarded through the Department of State by Consul-General Frank H. Mason, indicate that the greater part of the derogatory statements were inspired by those whose personal interests are opposed to the importation of American pork into Germany:

> The Hamburger Nachrichten publishes an article on "The swine import," which was obviously written by its best collaborator, Prince Bismarck. Naturally, the article is directed against the recent abrogation of the decree forbidding the importation of American pork. The germ of this opposition of the former imperial chancellor toward his successor is revealed, not so much with reference to the admission of American meat as against the American certificates of inspection. What Prince Bismarck says contains not an atom of fact, but a mountain of suspicions. Not only the American inspectors, but the officials of all other foreign

countries, are accused of being governed in their official actions more by sentiments of "patriotism" than by considerations of justice. This kind of controversy would be trivial and untenable if Minister Caprivi had accepted the suggestion which the Frankfurter Zeitung offered at the beginning of the current year, viz., that American pork should be inspected, on its arrival at German ports, by German officials.

In that event it would not have been necessary to trouble the American Government with any official microscopic inspection of meats intended for export. The American meat would have been just as carefully inspected for trichinæ by the German officials, and the wind would have been taken out of the sails of all these breezy polemics about the inefficiency of the American, and the infallibility of the German, inspectors. We should then have been brought more directly into contact with the question which, after all, is the one of most importance for Germany, viz., whether the German meat inspectors are really infallible as Prince Bismarck seems to believe. The recent occurrences in Mühl-Rädlitz, Altona, and Nieder-Löhme show clearly how carelessly the German officials conduct their examinations for trichinæ. While the American officials are accused, *a priori*, of carelessness and inefficiency, without a single fact being adduced to sustain such charge, there are, on the part of the German officials, obvious and undeniable facts which prove their neglect of real dangers to the public health. * * * We have recently published the judgment of a German university hygienist that the danger lies not in American but in German trichinæ. We can complete his verdict. It is not the American but the German trichinæ-inspectors who are dangerous to German pork consumers; for, if the German inspectors were efficient, it would be easy, through them, to protect German consumers from the alleged inefficiency of the American officials. But, if the German inspectors are careless and inefficient, the health of German consumers is definitely compromised.

BREMEN, *November 10.*

At the inspection station for imported freshly-slaughtered meats, as is reported by the Weser Zeitung, there was received, on the night of the 6th of the present month, a hog from Nieder-Löhme, which bore the official stamp, "Inspected," signed "Schaubez," and which was found to be swarming with trichinæ. It was accordingly seized by the police. The examination which was then made at the inspection station had the following result: In 15 of the 24 fields of the compressor were found 32 trichinæ; in one field, 8 or more. At the further inspection which took place at the inspector's office in the central abattoir there were found in the same 24 fields 66 trichinæ.

From these revelations it can be plainly seen that the inspection of slaughtered hogs at Nieder-Löhme is very carelessly performed. These trichinæ were all alive, and in a condition for further development; so that, if that meat had gone into consumption, it would have entailed the greatest danger to consumers.

In consideration of the recent occurrences at Mühl-Rödlitz and Altona, where there have been severe outbreaks of trichinosis, the curator of the central cattle market has immediately notified the chief official at Nieder-Löhme of the above facts, and has demanded the immediate dismissal of the negligent inspector. It can be safely assumed that the meat in question had not been inspected at all.

November 11.—A professor of hygiene at one of the German universities writes to us as follows: "Allow me to call the attention of the honored editor of the Frankfurter Zeitung to the fact that in the controversy which has apparently broken out again about the deleteriousness of American pork, that it is the duty of the press to prevent alarm from spreading further among the people, and to point out again that according to all experience we have had so far, the trichinæ in American meat does not reach Europe in a live condition. The forming of pond-like bodies of water, through strong smoking or salting, kills the animals in a short time, and therefore there has been hitherto not a single known case of trichinæ caused by the use of that kind of meat, not even in the countries where no embargo ever existed, and where for a long period large quantities of American meats have been used, as, for instance, in England and Holland. The German, not the American, trichinæ is dangerous. The animals killed here are eaten fresh, without preparation, and the notorious rigid inspection is in no way competent to decide with certainty whether trichinæ exist or not, as the epidemic in Mühl-Rädlitz and still later in Altona fully demonstrate. The use of trichinous American meat is not attended with danger. Against the danger with which the use of the German pork under like circumstances is attended, there is but one certain preventive measure, and this the hygienic authorities should lose no time in recommending, viz., complete abstinence from the use of raw pork (sausage, etc.), and to have it regularly boiled or roasted before being eaten."

November 7.—The royal district physician in Düsseldorf, Dr. Zimmerman, announces officially that, out of 688 pieces of American bacon which were inspected there on the 29th, 30th, and 31st of October, 12 pieces were found to contain trichinæ, some of them in great numbers. The Düsseldorf Daily Anzeiger, to which this information was communicated, comments thereon as follows:

"To the above we reply that we do not question the fact that trichinæ were found in the American meats which were presented for inspection; neither have we any reason to doubt a fact which has been officially communicated to us. What we do doubt, however, and what remains still, notwithstanding the official declaration of the district physician, an open question, is this: whether or not these sides of American bacon have really undergone the official American inspection. Upon this point hangs the whole public interest in the case; not alone for Düsseldorf and its vicinity, but for the whole of Germany. Since the officials have taken the trouble to make the above announcement, it is highly desirable that they should complete their declaration by informing the public under what precise conditions this circumstance has occurred; whether in fact the legally established precautions against trichinæ really protect the public, or whether some if not all of the Düsseldorf bacon had not previously passed our frontier in an irregular manner, and whether the trouble is not due to the negligence of our own customs officers."

We agree entirely with this view of the case. Instances have been reported to us in which the attempt has been made, through ignorance, to import shipments of bacon across the German frontier without proper certificates of inspection. These attempts have undoubtedly succeeded at certain frontier custom-houses. At all events, these alleged cases of trichinæ require to be fully substantiated. The mayor of Duisburg makes an official announcement in respect to this case, which had been formally reported to him, in which he gives notice that the police authorities are authorized and required to demand a reinspection of all imported pork before it is offered for public sale. All persons who wish to sell such meats should report them to the local meat inspectors, to be reinspected and restamped. Refusal to comply with this regulation should be severely punished. That which is prescribed in Duisburg should be enforced in other localities throughout Germany. Moreover, it would be much better if the Government would, at least provisionally, require the reinspection of all incoming American meats at our ports of entry, where complete facilities could be provided and the inspection carefully made without further trouble to the public or to local officials. The extension of the regulation announced by the mayor of Duisburg to all imported meats (not merely to American pork) would seem to be, at all events, somewhat too far reaching. The Government would do well to take the matter energetically in hand, if it does not wish this crusade against American trichinæ to be converted into a formal opposition to its system of political economy. Good laws are often discredited through maladministration; this danger appears to us to be also involved in the Imperial decree of the 3d September.

A press dispatch from Berlin, under date of December 12, says:

Dr. Braekbusch, the noted scientist, has made public the results of examinations of 3,000 specimens of American pork. Dr. Braekbusch found traces of trichinæ in about 2½ per cent of the specimens which passed through his hands. He experimented with cats and dogs, trying to infect them by feeding them with the diseased meat, but failed entirely. This the doctor considers positive proof that the trichinæ survive only a short time after the death of the infected animal. He holds that American pork, even of poor quality, is perfectly harmless when it reaches Germany.

This conclusion as to the destruction of trichinæ by the curing process is confirmed by all of the examinations and experiments which have been made in Germany and France. A considerable amount of evidence proving the innocuousness of the trichinæ-infected pork that had been properly salted was collected by the writer and published in the report of the commission which was appointed by President Arthur to investigate this matter, in 1883, and there have been absolutely no investigations made since which throw any doubt upon the conclusion reached at that time. The statement that Dr. Braekbusch found traces of trichinæ in 2½ per cent of the specimens which passed through his hands, if correct, shows very conclusively that he examined pork which had not been inspected before shipment from this country, as this is a larger percentage than exists in the average of hogs as they are examined here at time of slaughter.

By the system of inspection which is now enforced in this country, the inspected meats can be guaranteed as in every respect equal or superior to the meats inspected in any other country. The inspectors have been selected for their competency, a rigid discipline is maintained, and the inspection is from every point of view thorough and satisfactory. In addition to this, the people of the United States are more opposed to the use of the carcasses of animals affected with any form of disease than are the people of any other country, and for that reason animals are condemned here which would be freely passed for consumption abroad. Any objections raised to our inspected meats are, therefore, the result of hostility to our trade, and are in the highest degree unfair and unjust.

INTERNATIONAL CONGRESSES.

By authority and direction of the Secretary of Agriculture, the chief of the Bureau of Animal Industry attended, as the delegate of the Department of Agriculture, the International Congress of Hygiene and Demography, held in London, August 10–17, and the International Congress of Agriculture, held at The Hague, September 7–12. It affords me great pleasure to report that the representative of the Department received from both of these important bodies the most marked attention and very flattering evidences of their consideration. He was elected an honorary vice-president and member of the Foreign Council of section 3 of the Congress of Hygiene, which considered, during its sessions, the subject of the "Relations of the Diseases of Animals to those of Man." He was elected first vice-president of The Hague Congress, and also made a member of the Permanent Commission of the International Congress of Agriculture.

The importance and real value to the nation of the Department's being represented at such important deliberative assemblies can not be too highly appreciated. At both, questions were considered having the most direct bearing on our great export and import trade in food products; and at both there was occasion to explain the inspection service of this country and the care which is now being exercised here to prevent the shipment of animals affected with any contagious disease or of meats from animals in any way unsound.

The opportunity to become personally acquainted with the many distinguished delegates who represented the various countries of the world, some of them statesmen of great influence, and others scientists whose advice is sought by their governments, should be appreciated as one of the most important objects to be attained by representation at such gatherings. The spirit of friendliness and cordiality which pervaded all of the sessions indicates how favorably the relations of different countries may be modified by the personal contact of the men who, to so great an extent, influence the policy of their governments. The better these men become acquainted the more they learn to appreciate each other's integrity and honesty of purpose, and the fewer cases will there be of unjust regulations made by one country to injure the trade of another.

INSPECTION DIVISION.

On April 1, 1891, the force of the Bureau of Animal Industry was organized by order of the Secretary of Agriculture into four divisions, viz., the Inspection Division, the Division of Animal Pathology, the Division of Field Investigations and Miscellaneous Work, and the Division of Quarantine. The different branches of the work will therefore be considered under the head of the division to which each belongs.

To the Inspection Division was assigned all work of an executive nature, including the eradication of contagious diseases, the inspection of export and import animals, meat inspection, vessel inspection, and the regulation of the movement of Southern cattle.

The only disease which the Bureau has attempted to eradicate up to this time is that known as

CONTAGIOUS PLEURO-PNEUMONIA.

During the past fiscal year the lines of work laid out at the commencement of the operations against pleuro-pneumonia have been closely followed. The success of the Bureau's plans of fighting this disease in the States of Illinois, Pennsylvania, and Maryland demonstrated that what in some other countries had proved a failure could be successfully carried out. During the year no instance of this disease has been reported from either of the three States in which the Bureau had carried on its operations, and which, as a result of these operations, had been cleared of the disease. The last case discovered in Maryland occurred in October, 1889, and while very careful watch has been kept over the slaughtering establishments in the city of Baltimore, no further cases of the disease have developed in that city, once a stronghold of pleuro-pneumonia.

Pennsylvania, likewise, has been free of disease, and the inspection of slaughterhouses, which has been continued since the removal of the quarantine, has revealed no cases of pleuro-pneumonia since the removal of the quarantine above referred to. It has been deemed advisable to maintain a careful watch and constant inspection both at the stock yards and slaughterhouses in Philadelphia, owing to their proximity to the State of New Jersey, which has not yet been declared free of disease. This is a safeguard or precautionary measure which will be continued until the final extirpation of this disease from the entire United States.

THE WORK IN NEW YORK.

The radical and stringent measures, both of disinfection and in the matter of the movement of animals on Long Island, adopted in the early part of last year, have been strictly adhered to in that district during the past fiscal year, and have proved, as expected, successful. The troubles incident to the opposition of interested parties in the infected area of Kings and Queens Counties were soon lessened. The vigorous measures adopted led the parties who had before obstructed the work of the Bureau and secretly nursed contagious pleuro-pneumonia wherever possible, in order to introduce it into herds for their own profit, to realize that the Department was in earnest in its efforts to eradicate the disease, and would punish all who violated the law and its regulations.

The consequence has been that the disease no longer exists in these counties, and consequently the State of New York has at last been freed from this contagion. The last case discovered on Long Island was on April 30, 1891, and seven months have therefore elapsed without the development of any further cases of the disease. While the absence of contagious pleuro-pneumonia for a period of six months has been and is considered sufficient to demonstrate the freedom of a district from the disease, and the Department would be fully warranted in removing its quarantine restrictions at this time, it is recommended, in view of the fact that the contagion had existed for over fifty years in this district, that the quarantine regulations be maintained until April 30, 1892, a period of one year from the last appearance of disease.

From July 1, 1890, to June 30, 1891, there were inspected in New York 16,219 herds, containing 139,322 head of cattle; 134,464 animals were reëxamined, and 40,915 were tagged with numbered tags and registered upon the books of the Bureau. There were during this period ten new herds found infected with contagious pleuro-pneumonia, and these herds contained 172 animals, 40 of which animals were found to be diseased upon post-mortem. There were purchased for slaughter during the same time 35 affected cattle, at a cost of $1,016.63, an average of $29.05 per head; also 569 exposed cattle, at a cost of $13,846.05, an average of $24.33 per head. The smaller cost of the exposed cattle was due, as in previous years, to the fact that the amount which the owner realized for the carcasses was deducted from the appraised value, the Department paying the balance. One hundred and ninety-three stables and premises were disinfected during the year and post-mortem examinations were made upon 10,003 head of cattle, of which 40 were found diseased with pleuro-pneumonia.

The total expenses in the State of New York for the past fiscal year were $105,960.19, of which $14,862.68 was paid for cattle purchased for slaughter as either diseased or exposed. The remainder of these expenses constitutes the cost of disinfection, inspection, tagging, registering, supervising the movement of cattle, post-mortem examinations, and all the various expenses incident to a work of this character.

THE WORK IN NEW JERSEY.

In this State the work of suppressing pleuro-pneumonia has been continued with special vigor and strict enforcement of the regulations of the Department. The district infected has been confined to the counties of Hudson and Essex, and, while the number of herds found to be diseased have been few, they have been discovered at intervals so far apart as to have covered the fiscal year, and the time between the outbreaks has not been sufficient for us at any time to declare the disease completely eradicated. The great difficulty met with in handling pleuro-pneumonia in this State is due to the fact that the State of New Jersey has never coöperated by act of its legislature with the Bureau, nor given to the Bureau any authority to punish those who disregard the regulations of the Department. Under the State law the period of quarantine of premises in which diseased animals have been found is limited to 30 days. This is a length of time insufficient to protect new animals that may be brought upon the premises at its expiration, and this fact may account, in a large measure, for the continued existence of the disease in New Jersey. Within the past few months the Department has undertaken itself to enforce its regulations, independent of State coöperation, relying entirely upon the authority vested in it by the acts of Congress.

From July 1, 1890, to June 30, 1891, there have been inspected in New Jersey 7,697 herds, containing 61,230 head of cattle. Of this number 48,655 head were reëxamined and 6,903 tagged with numbered tags and registered upon the books of the Bureau. Only four new herds were found affected with pleuro-pneumonia during the year, containing 53 animals, 12 of which were pronounced diseased at the time the inspection was made. The total number of permits issued for the movement of cattle in this State was 1,329. There were purchased for slaughter during this period 12 head of affected cattle, at a cost of $382, and 67 exposed cattle, at a cost of $1,771.50. It was found necessary to disinfect but 13 premises and to make post-mortem examinations upon the carcasses of 6,208 animals, of which number only 12 were found diseased with pleuro-pneumonia.

The total expenses in New Jersey during the fiscal year 1891 were $42,918.37, of which $2,153.50 was paid for the purchase of cattle for slaughter because they were either diseased or had been exposed.

THE WORK IN MARYLAND.

The inspection of stock yards and slaughterhouses in Baltimore County, State of Maryland, was continued as a matter of precaution during the fiscal year. During this time 752 herds, containing 64,758 animals, were inspected, and 3,115 post-mortem examinations made. No disease was found during the fiscal year ending June 30, 1891, nor has any been found since that time. Two years have therefore elapsed since the discovery of any pleuro-pneumonia in the State of Maryland, and there can be no question that this State is now and will be for all time to come free from contagious pleuro-pneumonia, unless the contagion is again introduced by the importation of affected cattle.

THE WORK IN PENNSYLVANIA.

During the past year 1,128 herds, containing 45,508 animals, were inspected in Philadelphia, and 26,750 post-mortem examinations made. As stated before, no contagious pleuro-pneumonia was found and no cases have since been found.

THE WORK AS A WHOLE.

Including all the districts in which the Bureau has been carrying on its work of extirpating pleuro-pneumonia, as well as watching those districts from which it has eradicated this disease, there were inspected during the fiscal year ending June 30, 1891, a total of 25,796 herds, containing 310,818 animals. Of this number 183,119 animals were reexamined and 47,818 were tagged with numbered tags and registered upon the books of the Bureau.

The following table gives a résumé of this work, as given in detail above:

	New York.	New Jersey.	Maryland.	Pennsylvania.	Total.
Herds inspected	16,219	7,697	752	1,128	25,796
Cattle inspected	139,322	61,230	64,758	45,508	310,818
Cattle reëxamined	134,464	48,655			183,119
Post-mortem examinations	24,113	6,208	3,115	26,750	60,186
Diseased carcasses found	40	12			52
Cattle tagged	40,915	6,903			47,818
New herds found affected	10	4			14
Animals in affected herds	172	53			225
Diseased cattle purchased	35	12			47
Exposed cattle purchased	569	67			636
Premises disinfected	195	12			207

It may be interesting to note the number of diseased and exposed cattle which have been purchased and slaughtered each year since the work for the eradication of pleuro-pneumonia was commenced, as shown by the following table:

	1886–'87.	1887–'88.	1888–'89.	1889–'90.	1890–'91.	Total.
Diseased	1,342	2,398	1,903	676	47	6,366
Exposed	1,576	5,345	4,583	3,033	636	15,178

MOVEMENT OF SOUTHERN CATTLE.

The mildness of last winter made it necessary to commence the control of Southern cattle coming to Northern markets at an earlier period than for the preceding year, and on February 5, 1891, the necessary order regulating the movement of cattle in this branch of our interstate commerce was issued as follows:

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. Department of Agriculture,
Office of the Secretary,
Washington, D. C., February 5, 1891.

To the managers and agents of railroad and transportation companies of the United States, stockmen, and others:

In accordance with section 7 of the act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and of the act of Congress approved July 14, 1890, making appropriation for the Department of Agriculture for the fiscal year ending June 30, 1891, you are hereby notified that a contagious and infectious disease known as splenetic or Southern fever exists among cattle in the following-described area of the United States:

All that country lying east and south of a line commencing at the southeast corner of the Territory of New Mexico; thence running northerly along the eastern boundary of New Mexico to the southwestern corner of the county of Cochran, State of Texas; thence easterly along the southern boundaries of the counties of Cochran, Hockley, Lubbock, Crosby, Dickens, and King to the one hundredth meridian of longitude; thence northerly along said one hundredth meridian to the southern boundary of the State of Kansas; thence easterly along the southern boundary of the State of Kansas to the northeast corner of the Indian Territory; thence southerly along the eastern boundary of the Indian Territory to the southwestern corner of the State of Missouri; thence easterly along the southern boundaries of the State of Missouri, and the State of Kentucky and the State of Virginia to a point where said boundary is intersected by the Blue Ridge Mountains; thence in a northeasterly direction following said Blue Ridge Mountains, to the southwestern corner of the county of Madison, State of Virginia; thence easterly along the southern boundaries of the counties of Madison, Culpeper, and Stafford; thence northerly along the eastern boundary of Stafford County to the Potomac River; thence following the Potomac River, southerly to the Chesapeake Bay; thence easterly along the southern boundary of Maryland to the Atlantic Ocean.

From the fifteenth day of February to the first day of December, 1891, no cattle are to be transported from said area to any portion of the United States north or west of the above-described line, except in accordance with the following regulations:

(1) When any cattle in course of transportation from said area are unloaded north or west of this line to be fed or watered, the places where said cattle are to be so fed or watered shall be set apart, and no other cattle shall be admitted thereto.

(2) On unloading said cattle at their points of destination, pens shall be set apart to receive them, and no other cattle shall be admitted to said pens; and the regulations relating to the movement of Texas cattle, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars that have carried said stock shall be cleansed and disinfected before they are again used to transport, store, or shelter animals or merchandise.

(3) Whenever any cattle that have come from said area shall be reshipped from any of the points at which they have been unloaded to other points of destination, the car carrying said animals shall bear a placard stating that said car contains Southern cattle, and each of the waybills of said shipment shall have a note upon its face with a similar statement. At whatever point these cattle are unloaded they shall be placed in separate pens, to which no other cattle shall be admitted.

(4) The cars used to transport such animals and the pens in which they are fed and watered, and the pens set apart for their reception at points of destination, shall be disinfected in the following manner:

(*a*) Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime, diluted sulphuric acid, or, if not disinfected, it may be stored where no cattle can come in contact with it until after December 1.

(*b*) Wash the cars and the feeding and watering troughs with water until clean.

(*c*) Saturate the walls and floors of the cars and the fencing, troughs, and shutes of the pens with a solution made by dissolving four ounces of chloride of lime to each gallon of water. Or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

The losses resulting yearly to the owners of susceptible cattle, both in the interstate and export trade, by the contraction of this disease from exposure in unclean and infected cars and pens, and by means of the manure carried in unclean cars from place to place, and the threatened prohibition of our export trade by foreign governments because of the occurrence of this disease, have become a matter of grave and serious concern to the cattle industry of the United States. It is absolutely essential, therefore, that this cattle industry should be protected as far as possible by separating the dangerous cattle and by the adoption of efficient methods of disinfection.

A rigid compliance with the above regulations will insure comparative safety to Northern cattle and render it unnecessary to adopt a more stringent regulation, such as the absolute prohibition of the movement of Southern cattle except for slaughter during the time of year that this disease is fatal.

Inspectors will be instructed to see that disinfection is properly done, and it is hoped that transportation companies will promptly put in operation the above methods.

Very respectfully,

J. M. RUSK,
Secretary.

The quarantine line of the present year was extended from the Mississippi River east to the Atlantic Ocean, and it was endeavored as nearly as possible, having some regard to the State lines, to follow the line of permanent infection previously established, and as published in the Report of the Bureau of Animal Industry for the year 1884.

The system established by the regulations consisted in the separation of all cattle coming from south of this line at the first stock yards they entered, and the herding in separate pens, and the continuance of this inspection until they were finally slaughtered. All cars carrying this class of cattle were to be placarded with signs showing that they carried Southern cattle, and the waybills for these cars stamped with the words "From Southern fever district;" and all cars which transported this class of cattle were to be thoroughly cleaned and disinfected by the railroad companies before being again used for the transportation of cattle.

Some idea of the amount of work done by the Bureau in supervising the movement of Southern cattle may be had from the fact that 63,113 car loads, comprising 1,617,265 head of cattle, were inspected and kept separate and distinct during their transportation over the various railroads and through the different stock yards of the country.

It was not possible during the present season to maintain as rigid an inspection of the work of disinfecting cars, performed by the railroad companies, as was necessary to insure absolute safety in this traffic. The Department was compelled in a measure to rely upon the railroad companies for an observance of this part of the regulations and for the thoroughness of the work. While a large number of the railroad companies cheerfully complied with the regulations as to cleaning cars, and endeavored to carry them out thoroughly, it is also true that others were careless in attending to this matter, while still others failed to observe these regulations at all. The consequence, therefore, has been that while the outbreaks of Texas or Southern fever have been greatly diminished during the present season, they have still appeared in various parts of the country, and cases have occurred among cattle in our export trade. This is due to the failure of some railroads to comply with the regulations as to cleaning cars, and their use of unclean cars for cattle transportation.

In the export trade there has been reported up to the present time a total of 524 head of cattle affected with Southern fever. These cattle were, for the most part, infected through unclean cars, and it became necessary for the Department to schedule one railroad, which had failed to comply with the regulations, against the carrying of export cattle, and to issue positive instructions to our inspectors at interior yards that no cattle should be tagged or export granted unless the cars supplied by the railroads for their transportation were cleaned and disinfected immediately prior to their loading.

It is necessary that Congress enact some legislation to compel railroad companies to comply with the regulations for cleaning and disinfecting cars that have carried Southern cattle before this disease can be entirely prevented. At present there is no penalty or provision of law by which railroad companies can be held to a strict compliance with this rule, and the only means at the disposal of the Department is as regards export cattle, for which certificates of clearance may be refused if this rule is not complied with.

In the early part of the season urgent requests were made by the State authorities of Colorado and Wyoming that the Department permit cattle from south of its line to go into said States for grazing purposes. The line of inspection as established by these two States was considerably farther south than the line adopted by the Department, and it was claimed by them that their line was absolutely safe, and that they would assume all responsibility for any disease that might be taken into their States by the cattle shipped from this disputed area. For reasons which seemed at the time to possess sufficient weight this request was granted, and cattle were allowed to go from the area of country between the two lines to Colorado and Wyoming for grazing purposes, but upon condition that the same should be transported by rail and not allowed to cross ranges or trails of other cattle, nor be shipped to market until after December 1, 1891, as stated in the following order:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 23, 1891.

Notice is hereby given that cattle which have been at least ninety days in the area of country hereinafter described may be moved from said area by rail into the States of Colorado, Wyoming, and Montana, for grazing purposes, in accordance with the regulations made by said States for the admission of Southern cattle thereto: *Provided,* (1) That cattle from said area shall go into said States only for slaughter or grazing, and shall on no account be shipped from said States into any other State or Territory of the United States before the 1st day of December, 1891.

(2) That such cattle shall not be allowed in pens or on trails or ranges that are to be occupied or crossed by cattle going to the Eastern markets before December 1, 1891, and that these two classes of cattle shall not be allowed to come in contact.

(3) That all cars which have carried cattle from said area shall, upon unloading, at once be cleaned and disinfected in the manner provided by the regulations of this Department of February 5, 1891.

(4) That the State authorities of the States of Colorado, Wyoming, and Montana agree to enforce these provisions.

The area from which cattle may go into the States of Colorado, Wyoming, and Montana by rail for grazing, as above provided, is as follows: All that area included within the following boundary lines, viz: Commencing at the southeast corner of the Territory of New Mexico; thence running northerly along the eastern boundary of New Mexico to the southwestern corner of the county of Cochran, State of Texas; thence easterly along the southern boundaries of the counties of Cochran, Hockley, Lubbock, Crosby, Dickens, and King, to the one hundredth meridian; thence northerly along said one hundredth meridian to the Red River, where it crosses the eastern boundary of the county of Childress; thence following said Red River to the northwest corner of the county of Wichita; thence along the eastern boundaries of the counties of Wilbarger, Baylor, Throckmorton, and Shackleford; thence west along the southern boundary of Shackleford county; thence south along the eastern boundaries of Taylor, Rounels, Concho, Menard, and Kimble counties; thence west along the south lines of Kimble, Sutton, and Crockett counties; thence south along the east line of Pecos County to the Rio Grande River; thence along the Rio Grande River to the one hundredth meridian, and thence northerly along said meridian to the point of beginning.

J. M. RUSK,
Secretary.

It transpired that, notwithstanding the representations made by the authorities of these two States, cattle shipped from south of the Department's line and north of their line disseminated Texas fever in both Colorado and Wyoming, and there were considerable losses among the native cattle of these two States by infection from the Southern cattle introduced under this arrangement. It appears, therefore, that the line adopted by the Department can not be materially changed without grave danger to the cattle industry.

INSPECTION OF EXPORT ANIMALS.

This work has been continued under the provisions of the act of Congress of August 30, 1890, and covers the inspection of animals at interior stock yards, the tagging of animals at these points with numbered metal tags, and the collection and recording of a history of the animals at the time of tagging, the reinspection of these animals at the port of export, and the loading of the same on board vessels.

The following tables show the details of this work for the fiscal year ending June 30, 1891:

Statement showing number of animals tagged and inspected for export from the commencement of such work, November 15, 1890, to close of the fiscal year 1891.

Place.	Export cattle tagged.		Total.	Export cattle inspected.		Total.	Cattle rejected on inspection on account of disease.	Export sheep inspected Jan. 1 to June 30, 1891.
	Nov. 15 to Dec. 31, 1890.	Jan. 1 to June 30, 1891.		Nov. 15 to Dec. 31, 1890.	Jan. 1 to June 30, 1891.			
New York, N. Y	9,844	10,781	20,625	19,368	57,769	77,137	50	7,447
Boston, Mass	6,143	17,771	23,914	15,620	48,231	63,851	30	1,529
Portland, Me	3	3	6	412	1,797	2,209	1	....
Baltimore, Md	10,589	11,761	22,350	11,639	33,513	45,152	4	1,643
Newport News, Va	1,950	7	1,957	2,890	1,831	4,721	1	....
West Point, Va	499	1	500	541	350	891	0	....
Norfolk, Va	337	....	337	337	325	662	0	....
Philadelphia, Pa	801	1,170	1,971	1,284	6,561	7,845	0	709
New Orleans, La	....	250	250	....	250	250	0	....
Chicago, Ill	18,643	103,463	122,106	18,643	103,463	122,106	78	10,486
Buffalo, N. Y	4,501	4,784	9,285	4,501	15,114	19,615	7	....
Pittsburg, Pa	18	384	402	2,918	12,081	14,999	0	....
Aggregate	53,328	150,375	203,703	78,153	281,285	359,438	171	21,814

Statement showing exports of domestic cattle to Europe during the fiscal year ending June 30, 1891.

Port of export.	Great Britain.	Germany.	Belgium.	France.	Total.
First half—six months ending December 31, 1890.					
New York, N. Y	83,411	1,390	3,009	3,223	91,033
Boston, Mass	58,727	137	802		59,666
Baltimore, Md	40,985	368	1,602	703	43,658
Philadelphia, Pa	7,982				7,982
New Orleans, La	189				189
Portland, Me	412				412
Norfolk, Va	686				686
Newport News, Va	5,616	185	352	1,327	7,480
West Point, Va	1,496				1,496
Aggregate	199,504	2,080	5,765	5,253	212,602
Second half—six months ending June 30, 1891.					
New York, N. Y	53,552	2,539	552	299	56,942
Boston, Mass	47,871	360			48,231
Baltimore, Md	32,376	539	265	333	33,513
Philadelphia, Pa	6,561				6,561
New Orleans, La	250				250
Portland, Me	1,797				1,797
Norfolk, Va	325				325
Newport News, Va	1,831				1,831
West Point, Va	350				350
Aggregate	144,913	3,438	817	632	149,800
Aggregate, fiscal year 1891	344,417	5,518	6,582	5,885	362,402

The exports of cattle for the fiscal year ending June 30, 1891, show a decrease of 3¾ per cent compared with the exports for the fiscal year ending June 30, 1890. The total exports for 1891 amounted to 362,402, as against 372,690 for the preceding fiscal year. The cause of this decrease in exports is undoubtedly due to the increase in prices of cattle in this country during the latter part of the fiscal year, cattle bringing in June, 1891, from $1.25 to $1.50 per 100 pounds more than in June, 1890.

INSPECTION OF IMPORTED ANIMALS.

The act of August 30, 1890, provides for the inspection of all imported cattle, sheep, and swine arriving in the United States. This work was inaugurated by the Bureau immediately after the passage of the act, and has been continued in accordance with its regulations. Inspection stations have been established along the Canadian border, and the three quarantine stations along the Atlantic seaboard, which were already in existence, have been maintained under the direction of the quarantine division. At the commencement of this work stations were established along the Mexican border, but since the provisions of the present tariff law went into effect no importations of cattle, sheep, or swine have been made from Mexico, and for this reason these stations were discontinued. The total number of animals inspected to June 30, 1891, imported at our Canadian stations, were 2,218 cattle, 44,948 sheep, and 29 swine. At the quarantine stations on the Atlantic seaboard there were imported and quarantined for ninety days 45 cattle, imported for breeding purposes; also 776 sheep and 70 swine quarantined for fifteen days.

Owing to the failure of the Dominion of Canada to provide for the quarantine of sheep arriving in that country from countries infected with foot-and-mouth disease, the Secretary of Agriculture, on May 19, 1891, issued an order quarantining all sheep and swine imported from Canada into the United States for a period of fifteen days, as follows:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., May 19, 1891.

Whereas under the act of Congress approved August 30, 1890, it has been provided by the Department of Agriculture, in order to protect the sheep and swine of the United States from contagious diseases now existing in foreign countries, that all sheep and swine imported from Great Britain and the continent of Europe must be held in quarantine for a period of not less than fifteen days; and

Whereas the Dominion of Canada makes no requirement of quarantine for sheep and swine imported into that country from Great Britain or the continent of Europe; and

Whereas to permit importations of these animals from Canada into the United States without quarantine would be dangerous to the stock interests of the United States, owing to the failure on the part of the Canadian authorities to enforce this measure of protection, and would enable importers to evade the quarantine at United States ports: Therefore, it is

Ordered, That all sheep or swine to be imported from Canada into the United States are hereby made subject to the regulations of the Department of Agriculture of date October 13, 1890, and the exception contained in the third and sixth regulations of said date, as applicable to Canadian sheep and swine, is hereby rescinded, and all animals named in said regulations, except cattle imported from Canada, are subject to the same conditions and requirements as if they were imported into the United States from Great Britain or the continent of Europe.

J. M. RUSK,
Secretary.

Some time thereafter the Dominion of Canada, by an order of council, established a quarantine of fifteen days on all sheep and swine imported into said Dominion from Great Britain or the continent of Europe. As this quarantine of the Canadian Government corresponded with that adopted by the Department of Agriculture of the United States, the following order was issued on June 25, 1891, rescinding the order of May 19:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 25, 1891.

Whereas on May 19, 1891, the Department of Agriculture, under the act of Congress approved August 30, 1890, issued an order providing that all sheep and swine to be imported from the Dominion of Canada into the United States should be subject to a quarantine of fifteen days at the port of entry, this order being issued upon the ground, as stated therein, that the Dominion of Canada had made no provision for a quarantine for sheep and swine imported into that country from Great Britain or the continent of Europe; and

Whereas the said Dominion of Canada, on the 6th day of June, 1891, by an order in council, duly established a quarantine of fifteen days on all sheep and swine imported into said Dominion from Great Britain or the continent of Europe: Now, therefore, it is

Ordered, That the quarantine of sheep and swine imported from Canada into the United States, required by the aforesaid order of May, 1891, is hereby removed, and sheep and swine may be imported from Canada into the United States without quarantine: *Provided*, That on inspection of said sheep or swine at the ports of entry they are found to be free of disease: *And provided further*, That sheep or swine imported into the United States from Great Britain or the continent of Europe through Canada shall have been held in quarantine by the Canadian Government for fifteen days, and the importer shall produce at the port of entry into the United States a certificate from the proper quarantine officer of said Government showing the fact of said quarantine.

J. M. RUSK,
Secretary.

The only contagious disease found among animals imported at our quarantine stations during the past year was among a shipment of

22 Southdown sheep from England, which entered at our quarantine station at Garfield, N. J., and in which shipment were 11 animals affected with foot-rot. This shipment was detained in quarantine until the disease had entirely disappeared. The only other instance of disease occurred in a shipment of sheep from Canada, imported at Island Pond, Vt., in which were found five cases of foot-rot out of a shipment of 102 head. These were treated in the same manner as the sheep found diseased at the Garfield quarantine station.

The following tables show the results of the inspection of imported animals in detail:

Statement showing number of imported animals inspected by inspectors of the Bureau of Animal Industry from the commencement of inspections, November 15, 1890, to close of the fiscal year 1891.

Port of entry.	Nov. 15 to Dec. 31, 1890.			Jan. 1 to June 30, 1891.			Total.		
	Cattle.	Sheep.	Swine.	Cattle.	Sheep.	Swine.	Cattle.	Sheep.	Swine.
Portland, Me		102						102	
St. Albans, Vt				1, 618			1, 618		
Island Pond, Vt				383			383		
Newport, Vt				86			86		
Ogdensburg, N. Y		547		8	3	3	8	550	3
Cape Vincent, N. Y	1	1, 080		7	43	3	8	1, 123	3
Morristown, N. Y				6			6		
Buffalo, N. Y		23, 210		6	19, 058		6	42, 268	
Suspension Bridge, N. Y				14	84	2	14	84	2
Detroit, Mich				24	58	4	24	58	4
Port Huron, Mich	3	168		62	573	17	65	741	17
Brownsville, Tex		22						22	
Aggregate	4	25, 129		2, 214	19, 819	29	2, 218	44, 948	29

NOTE.—This statement does not include imported live stock received at the quarantine station located on the seaboard.

INSPECTION IN GREAT BRITAIN.

The inspection by American veterinarians of American cattle landed at the foreign animal wharves in Great Britain has been continued during the present year. It had been frequently alleged by the British Government that our cattle arriving in that country were affected with contagious pleuro-pneumonia, and their inspectors were continually reporting the arrival of diseased animals. The last report of the chief veterinary surgeon of Great Britain, for example, states that 14 animals from America had been found affected with contagious pleuro-pneumonia during 1890.

To ascertain upon what foundation these allegations were based, the Department established this transatlantic inspection in August, 1890. During its continuance but three cases of alleged pleuro-pneumonia have been reported by the British inspectors. The report of the American inspectors on those cases was to the effect that the disease was not contagious pleuro-pneumonia, but a form of interstitial pneumonia; and a consideration of all the facts, together with an examination of portions of the lungs forwarded to the Department by our inspectors, satisfied the chief of the Bureau of Animal Industry that the claim of the British authorities could not be maintained. The position taken by the American inspectors was confirmed by Prof. Williams, principal of the new Veterinary College, Edinburg, one of the most eminent veterinarians in the profession, as well as by his son, a professor in the same institution, and by Dr. J. E. Ryder, member of the American Veterinary College, who was in England at the time. As the history of animals alleged to be affected with this disease is of the greatest importance in reaching a correct diagnosis, every effort was made to obtain this in the most complete and reliable form. The animals claimed to have been affected were tagged in this country prior to their export, and the names of the owners, feeders, and the locality from which they came were recorded in the books kept by the Bureau. Obtaining, therefore, the tag numbers of these animals from our inspector abroad, we were enabled to make a careful examination of their history and trace them back to the farms on which they were reared. The result of this investigation demonstrated clearly that there had not been any disease of this character in the locality or neighborhood from which these animals came, nor on the farms upon which they were born and reared; nor had there been any possibility of exposure to the disease in course of transportation to the port of export. This history, in connection with the diagnosis of our inspectors, clearly established the fact that the claim made by the British authorities could not possibly be maintained.

In this connection it might be well to observe that these cases, and other cases of alleged pleuro-pneumonia claimed to have been found by the British authorities, occurred during the winter and spring months, at a time when cattle in the course of transportation across the Atlantic were exposed to storms and severe cold weather, tending to develop lung trouble and pneumonia in other forms than that of a contagious character. It is, therefore, safe to conclude that all the alleged cases of this disease said to have been found by the British veterinarians among American cattle were simply forms of pneumonia caused by the exposure incident to a voyage across the Atlantic during a cold and stormy period of the year.

The total number of animals inspected by our veterinarians stationed in Great Britain from the time of their commencement of work to June 30, 1891, was 289,745 head of cattle and 6,989 sheep. The following table shows the work of inspection at British ports for the fiscal year ending June 30, 1891:

Statement showing losses at sea and number of domestic cattle and sheep inspected by the inspectors of the Bureau of Animal Industry at London, Liverpool, and Glasgow from the commencement of inspections at those ports, August 16, 1890, to June 30, 1891.

Port.	Cattle.						Sheep.	
	August 16 to December 31, 1890.		Six months ending June 30, 1891.		Total.		May 1 to June 30, 1891.	
	Inspected.	Loss at sea.	Inspected.	Loss at sea.	Inspected.	Loss at sea.	Inspected.	Loss at sea.
London	57,874	1,742	60,466	877	118,340	2,619	2,149	30
Liverpool	71,339	527	69,518	551	140,857	1,078	3,397	90
Glasgow	14,850	498	15,689	548	30,548	1,046	1,443	1
Aggregate	144,072	2,767	145,673	1,976	289,745	4,743	6,989	121

Aggregate loss: Cattle, $1\frac{5}{8}$ per cent; sheep, $1\frac{7}{10}$ per cent.

VESSEL INSPECTION.

Under the act of March 3, 1891, this Department was empowered to regulate the fittings of vessels carrying export cattle from the United States to foreign countries, and on June 6, 1891, the following regulations, designed to promote the better carrying of cattle, the more humane treatment of the same, and to insure their arrival at points of destination in better condition, were promulgated:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 6, 1891.

Pursuant to the authority invested in the Secretary of Agriculture by virtue of an act of Congress approved March 3, 1891, entitled "An act to provide for the safe transport and humane treatment of export cattle from the United States to foreign countries, and for other purposes," the following regulations are hereby prescribed for vessels engaged in the transportation of cattle from the United States to foreign countries:

(1) The owners, agents, or master of any vessel desiring to transport cattle from any port of the United States will make application to the Secretary of Agriculture at Washington, D. C., for a certificate of register. Said application shall be made upon a blank form furnished by the Department of Agriculture to be filled out by the applicant, and on receipt of the same the Secretary of Agriculture will direct the veterinary inspector in charge of the port from which said vessel is to clear to examine said vessel, and if the same has complied with the regulations hereinafter prescribed a certificate of registry will be issued, good for the term of one year, which will entitle said vessel to engage in the trade of carrying export cattle, and will state the number of cattle which said vessel may transport: *Provided, however,* That any certificate of registry issued shall be subject at any time to cancellation upon the violation of any of these regulations by said vessel, and that the veterinary inspector of the port may from time time make such changes in the fittings of said vessel as in his judgment may seem necessary.

SPACE.

(2) Cattle carried on the upper or spar deck must be allowed a space of 2 feet 6 inches in width by 8 feet in depth per head. No more than 4 head of cattle will be allowed in each pen. Cattle loaded between decks must be allowed a space of 2 feet 8 inches in width by 8 feet in depth, no more than 4 head being allowed in each pen, except at the end of a row, where 5 may be allowed together.

(3) Vessels will be allowed to carry three deck loads of cattle, but where it is desired to carry cattle on the lower or steerage deck special permission must be obtained from the inspector, which will only be granted in cases where said deck is provided with sufficient ventilation, as hereinafter prescribed.

UPPER-DECK FITTINGS.

(4) *Stanchions, wooden.*—Stanchions must be of good sound timber, 4 by 6 inches, placed at proper distances from centers, against ship's rail and inside stanchions, in their proper place directly in line with outboard stanchions, to be set up so that the 6-inch way of the stanchion shall set fore and aft. A proper tenon shall be cut on the head of same to receive the thwart-ship beam. The tenon not to be less than 3 inches in length and the shoulder not less than 2¼ inches on each side of the stanchion, thus leaving the tenon 1½ inches thick. A piece of 2 by 3 inches or 2-inch plank shall be fastened to the outside of stanchion and run up to underneath rail to chock stanchion down and prevent lifting when beam is sprung to crown of deck. Open-rail ships shall be blocked out on backs of stanchions fair with the outside of rails to receive the outside of planking. Where upper-deck fittings are not permanent, the heels of outside stanchions shall be secured by a bracing of 2 by 3 inch sound lumber from the back of each stanchion to shear-streak or waterway, the heels of inside stanchions being properly braced from and to each other. Bulwark stanchions must also be extra stanchioned by raking shores running diagonally from the top of the stanchions to the deck.

Stanchions, iron.—These may be used in place of wooden stanchions and should be not less than 2 inches in diameter, set in iron sockets above and below and fastened with nut and bolt.

Hook bolts or clamps.—Hook bolts or clamps must be made of ⅝-inch wrought iron with hook on outboard end and thread and nut on inboard end, to pass over and under rail and through outboard stanchion and set up on the inside of same with a nut. These bolts may be double or single. If double then no thread or nut is necessary, but the stanchion will lie shipped through it, thus double hooking the rails. This will be found very useful where funnels or other deck fittings come in the way of beams passing from side to side of ship.

Beams.—Beams must be of good sound lumber, 3 by 6 inch, to run clear across the ship beam where practicable. Should any house or deck fittings be in the way, then butt up closely to same. These beams shall have a 1½ by 4 inch mortise cut in to receive the tenon of each and every stanchion, and to take the same crown as deck of ship by springing down to shoulder of outside stanchions, and to be properly pinned or nailed to tenon and wedged tightly afterwards. The mortises shall be cut not less than 6 inches from outside ends of beams and a piece nailed on outside of same, and trimmed off fair with beam ends to prevent splitting.

Diagonal braces from stanchions to beams.—Diagonal braces shall be fastened on each stanchion on both sides of same, running up to top side of beam and properly secured by well nailing to both stanchion and beam.

Headboards.—Headboards shall be not less than 2 by 10 or 3 by 8 inches, of good sound lumber, and secured to every stanchion by ⅝-inch screw bolts passing through same and set up on same with a nut. Where headboards butt on a stanchion a piece of 1½-inch pine lumber shall be placed over the butts, like a butt strap, the bolts to go through same and be set up with a nut on the stanchions. These headboards can be placed on either side of the stanchions. All headboards shall have 1½-inch holes bored through them at proper distance to tie the animals.

Footboards.—Footboards shall be of the same material as headboards, properly nailed or bolted to stanchions on the inside of same.

Division boards.—Division boards shall be of 2-inch sound lumber, fitted so as to be removable at any time, and so arranged as to divide the animals into lots of four, thus making compartments for this number all over the vessel. These division boards may be fitted perpendicularly or horizontally.

Flooring.—Flooring shall be of 1-inch boards, laid fore and aft on ships with wooden decks at the option of the owners. Iron-decked ships shall be sheathed with 2-inch spruce, hemlock, or yellow pine, or with 1-inch hemlock; but if 1-inch hemlock is used then the foot locks shall be 3 by 4 inches, to be laid so that they will properly secure the 1-inch boards, thus preventing them from slipping and at the same time acting as foot locks by showing a surface of 2 by 4 inches to correspond with the 2 by 3 inches. It is optional with the owners whether they permit sheathing to be used on their ships with wooden decks, or whether they allow foot locks to be secured to the deck. But on iron decks it is absolutely necessary (if permanent foot locks are not down) to sheath them before putting down the foot locks, in order to fasten same. Cement can be used instead of wood sheathing, and foot locks molded in same.

Foot locks.—Foot locks shall be of good sound lumber, size 2 by 3 inches or 3 by 4 inches hemlock, laid fore and aft of ship, placed 12 inches, 14 inches, 2 feet 2 inches, and 14 inches apart, the first one distant 12 inches from inside of footboard, filled in athwart ships opposite each stanchion, properly secured to sheathing or deck, and secured by a batten to go over all from stanchion to stanchion. When troughs are used, foot locks will be placed 17, 16, 22, and 16 inches apart.

Outside planking.—All outside planking on open and closed railed ships must be properly laid fore and aft of ship and nailed to the backs of stanchions, as close as possible for the cold season, and for the warmer months the top-course planking shall be left off fore and aft of ship in order to allow a free circulation of air. Nothing less than 2-inch spruce or 1½-inch yellow pine is to be used for this purpose. There shall be placed over each seam of outside planking a 1 by 5 inch batten securely nailed thereto, which will help to exclude wind and water.

PLANKING OF SHELTER DECK, TO BE ERECTED ON SPAR-DECKED SHIPS.

The plank to be nailed on this deck is simply to shelter the cattle, and it should be laid with 1½-inch sound lumber.

PLANKING OF SHELTER DECK, TO BE ERECTED ON WELL-DECK SHIPS.

The plank to form the shelter deck on well-deck ships shall be laid with 2-inch sound lumber sufficient to cover cattle. This plank shall be laid as closely as possible and well nailed to the beams, thus making a good deck from which to work the ship's gear.

Nails.—No nails less than 20-penny shall be used in foot locks or where 2-inch material is used. Twelve-penny nails can be used in 1½-inch plank or under.

UNDER-DECK FITTINGS.

Stanchions.—Stanchions shall be of good sound lumber 4 by 6 inches, set up at proper distances from centers so that the 6-inch way of same shall stand fore and aft and jammed in tight between the two decks, properly braced on head and from side to side of ship; this bracing shall be of 2 by 3 inch spruce or yellow pine and be properly butted against each stanchion. Where it is found impracticable to run these braces across ship, by reason of hatches, etc., coming in the way, then they shall be well braced from hatch combings and from the obstruction which prevents running braces from side to side. The heads of these stanchions shall be braced fore and aft by 2 by 3 inch pieces well nailed on each stanchion and running fore and aft close up to the lower edge of the ship beams and butted at each end of compartment and against themselves, or chocked in underneath beam and well nailed to heads of stanchions. If upper and lower decks are wood, then the stanchions set up between decks may be secured by well cleating to each deck at heads and heels of same.

Headboards.—Headboards shall be of the same dimensions as those on the upper deck, fastened in the same manner, with 1½-inch holes bored at right distances to tie animals.

Footboards.—Footboards shall be of same dimensions as those on upper deck, and fastened in the same manner.

Division boards.—Division boards shall be fitted perpendicularly or horizontally, and arranged so that they divide the animals into pens of 4, or, at end of row, into pens of 5, and shall ship or unship by forming a slide on cargo battens to head and foot boards or on stanchions.

Flooring.—Where ships have decks of wood it shall be optional with owners whether they have boards put down to protect decks, or whether they allow the foot locks to be nailed to the ship's deck. (Permanent foot locks may be put down.) If the decks are of iron then wooden flooring must be laid either of 2-inch spruce with 2 by 3 inch foot locks, or of 1-inch hemlock with 3 by 4 inch foot locks, same as provided for upper decks. Cement may also be used instead of wood flooring, molding the foot locks in their proper places between same.

Foot locks.—Foot locks may be put down any size over 2 by 3 inches, but nothing under this size shall be used. They should be laid fore and aft of ship at distances mentioned in upper-deck fittings, and be well fastened to either deck or flooring, or to themselves, and properly filled in athwart ships between stanchions, same as on upper deck.

Troughs.—Suitable troughs may be formed on the footboards about 12 inches wide, when required, by nailing footboard on outside of stanchion and fitting up on the inside.

Casing for steering gear.—A suitable casing must be placed over the ship's steering gear when found necessary.

Alleyways.—Alleyways between the pens must not be less than 18 inches, unless otherwise authorized by inspectors.

VENTILATION.

(5) Each compartment containing cattle must have at least four bell-mouthed ventilators of not less than 18 inches inside diameter and with tops exceeding 7 feet in height, two situated at each end of the compartment.

(6) Vessels desiring to carry cattle on third deck may obtain special permit from the inspector of the port, when said vessel is fitted same as second deck and properly ventilated.

(7) No cattle shall be loaded along the alleyways by engine room unless side of said engine room is covered by 1½-inch grooved and tongued lumber, making a 3-inch air space.

(8) No cattle shall be loaded on hatches on decks above cattle, nor shall any merchandise, freight, or food for cattle be loaded on said hatches, but said hatches shall at all times be kept clear.

(9) Only two days' feed for cattle, at the discretion of port inspectors, shall be allowed to be carried on deck, properly covered, and this must be the first feed used.

(10) All vessels will carry not less than four hogsheads of over 100 gallons capacity for each 100 head of cattle, and these shall be filled with fresh water before sailing and refilled as emptied.

(11) Vessels will require shippers to furnish a foreman to be in charge of cattle, and 1 cattleman for each 25 head of cattle shipped. Three-fourths of the men in charge of a shipment of cattle must be experienced men who have made previous trips with cattle, and who must satisfy the veterinary inspector at the port, by satisfactory evidence, that they are capable and reliable. Shippers will notify the inspector of the port two days before the sailing of a vessel of the name of the foreman to be in charge of their shipment and of the names of the attendants, and the veterinary inspector will certify said men to the captain of the vessel if he has reason to believe they are reliable. The captain of the vessel will report to the veterinary inspector of the port on his return as to the conduct and efficiency of each of the men in charge of cattle on his previous trip, and such men as have been found to be

unsuited to be in charge of cattle will thereafter be refused certification to go with any shipment of cattle by the inspector of the port.

(12) Cattle will be tied with ¾-inch rope, which shall not be used more than once.

(13) On vessels having false decks upon which cattle are loaded, these must be removed and the manure and dirt cleaned from underneath before receiving another cargo of cattle.

(14) No vessel will be allowed to take on board any cattle for export unless the same have been at the port of embarkation at least twenty-four hours before the vessel sails, except in special cases and by direction of inspector.

(15) The inspector of the port may, in case he finds any of the fittings are worn, decayed, or appear to be unsound, require the same to be replaced before he clears the vessel. He will also supervise the loading of cattle and see that they are properly stowed and tied, and that all the requirements of these regulations have been complied with.

J. M. Rusk,
Secretary.

The various steamship companies engaged in this traffic have very cheerfully accepted these regulations, and, at some expense, have remodeled their vessels so as to comply with them. The result so far of the vessel inspection regulations has been to reduce losses from suffocation and weak fittings in vessels. The total number of vessels examined from July 1 to September 19, 1891, was 215, of which 98 sailed from the port of New York, 52 from the port of Boston, 42 from the port of Baltimore, 15 from the port of Philadelphia, and 8 from the port of Newport News.

MEAT INSPECTION.

The most important work of the Bureau, placed upon it by the act of Congress of March 3, 1891, is that of meat inspection; important not only in view of the vast amount of work necessary to carry the provisions of this law into operation, but from its effect upon the commerce of the nation and the health of our people. The act of Congress of August 30, 1890, provided for the inspection of salted pork and bacon. It was the intention of Congress in passing this measure to enact a law which would enable this Government to so certify to the wholesomeness of our pork products that it would entitle them to entry into foreign countries. The provisions of this act, however, referred more particularly to an inspection which would determine the character and manner in which these products were packed and their condition at time of shipment, and did not reach to the more important object of determining whether the animals from which they came were diseased or not at the time of slaughter. The consequence was that foreign governments refused to recognize such inspection or certificates issued thereunder as sufficient to warrant the removal of the prohibition which they had for many years maintained against American pork.

In prescribing, therefore, regulations under the act of March 3, 1891, provision was made for a microscopic examination of hogs at time of slaughter, in order to certify that the same were free of the animal parasite called *trichina spiralis.* In addition to the provisions for microscopic inspection of pork, the regulations provided for an examination at time of slaughter by veterinary surgeons of all animals slaughtered for export or interstate trade, the condemnation of animals found to be diseased, and the proper identification of carcasses and the products of the same which entered into these two classes of our commerce.

The regulations governing the work of meat inspection are as follows:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 25, 1891.

The following rules and regulations, being additional to the rules and regulations heretofore made under the act of Congress approved August 30, 1890, are hereby prescribed for the inspection of live cattle, hogs, and their carcasses, by virtue of the authority conferred upon the Secretary of Agriculture under the provisions of the act of Congress approved March 3, 1891, entitled "An act to provide for the inspection of live cattle, hogs, and the carcasses and products thereof which are the subjects of interstate commerce, and for other purposes."

EXPORT CATTLE INSPECTION.

(1) The order and regulations providing for the inspection of export cattle and sheep, made October 20, 1890, under the provisions of section 10 of the act of Congress approved August 30, 1890, are hereby continued in full force and effect, the same as if made under the provisions of the act of March 3, 1891, and all exporters, to secure clearance for their shipments of cattle, must comply strictly with the said regulations.

MEAT INSPECTION.

(2) The proprietors of slaughterhouses, canning, salting, packing, or rendering establishments, engaged in the slaughter of cattle, sheep, or swine, the carcasses or products of which are to become subjects of interstate or foreign commerce, will make application to the Secretary of Agriculture for inspection of said animals and their products.

(3) The said application must be in writing, addressed to the Secretary of Agriculture, Washington, D. C., and shall state the location and address of the slaughterhouse or other establishment, the kind of animals slaughtered, the estimated number of animals slaughtered per week, and the character and quantity of the products to go into interstate or foreign commerce from said establishment; and the said applicant in his application shall agree to conform strictly with all regulations or orders that may be made by the Secretary of Agriculture for carrying on the work of inspection at such establishment.

(4) The Secretary of Agriculture, upon receipt of said application and after consideration thereof, will give said establishment an official number, by which all its inspected products will thereafter be known, and this number will be used both by the inspectors of the Department of Agriculture and by the owners of said establishment to mark the products of the establishment, as hereinafter prescribed.

(5) The Secretary of Agriculture will appoint and designate a veterinary inspector to take charge of the examination and inspection of animals and their products for each establishment which has been officially numbered, as prescribed by Rule 3, and will detail to such inspector such assistants or other employés as may be necessary to properly carry on the work of inspection at such establishment. The inspector appointed, and all employés under his direction, shall have full and free access at all times to all parts of the building or buildings used in the slaughter of live animals and the conversion of their carcasses into food products.

(6) The veterinary inspector in charge of said establishment will carefully inspect all animals in the pens of said establishment about to be slaughtered, and no animal shall be allowed to pass to the slaughtering room until it has been so inspected. Whenever any animal is found on said inspection to be diseased, said animal shall thereupon be condemned by the inspector, and the owner of the same shall at once remove it from the premises and dispose of it in such manner as may be provided by the laws of the State in which said animal is located.

(7) The veterinary inspector or his assistant shall carefully inspect at time of slaughter all animals slaughtered at said establishment and make a post-mortem report of the same to the Department. Should the carcass of any animal, on said post-mortem examination, be found to be diseased and unfit for human food, the said carcass shall at once be removed from said establishment under the supervision of the inspector and be disposed of in the manner provided by the laws of the State where slaughtered. Any owner of any establishment in which inspections are being made under the provisions of the act of March 3, 1891, who shall willfully cause or permit any animal which, upon inspection, has been found to be diseased to remain on said premises beyond the time allowed by the inspector in charge for its removal, shall forfeit his right to inspection, and said establishment will, for such time as the Secretary may direct, be refused certificates of inspection upon its products.

(8) The carcasses of cattle which leave said establishment as dressed beef will be stamped by said inspector with a numbered stamp issued by the Department of

Agriculture, and a record of the same will be sent to the Department at Washington.

(9) Each and every article of food products made from the carcasses of animals inspected will be labeled or marked in such manner as the owner of said establishment may direct; said label, however, must bear the official number of the establishment from which said product came and also contain a statement that the same has been inspected under the provisions of the act of March 3, 1891.

A copy of said label must be filed at the Department of Agriculture, Washington, D. C., and, after filing, said label will become the mark of identification showing that the products to which it has been attached have been inspected, as provided by these rules and regulations, and any person who shall forge, counterfeit, alter, or deface said label will be prosecuted under the penalty clause of section 4 of the act of March 3, 1891.

Each and every package to be shipped from said establishment to any foreign country must have printed or stenciled on the side or on the top, by the packer or exporter, the following:

FOR EXPORT.

(*a*) Official number of establishment.
(*b*) Location of factory.
(*c*) Number of pieces or pounds.
(*d*) Trade-mark.

In case said package is for transportation to some other State or Territory or to the District of Columbia, in place of the words "For Export" the words "Interstate Trade" shall be substituted.

The letters and figures in the above print shall be of the following dimensions: The letters in the words "For Export" or the words "Interstate Trade" shall not be less than three-fourths of an inch in length, and the other letters and figures not less than one-half inch in length. The letters and figures affixed to said package shall be legible and shall be in such proportion and of such color as the inspector of the Department of Agriculture may designate.

(10) The inspector of the Department of Agriculture in charge of said establishment, being satisfied that the articles in said packages came from animals inspected by him, and that they are wholesome, sound, and fit for human food, shall affix to the top of said packages meat-inspection stamps to be furnished by the Department of Agriculture, said stamps bearing serial numbers, and the inspector will write on said stamps the date of inspection.

The stamp must be securely affixed by paste and tacks in such a way as to be easily read when the package is standing on its bottom. Not less than five tacks shall be driven through each stamp, one at each corner and one in the middle of the stamp.

The stamp having been affixed, it must be immediately canceled. For this purpose the inspector will use a stencil plate of brass or copper, in which will be cut five parallel waved lines long enough to extend beyond each side of the stamp on the wood of the package. At the top of said stencil will be cut the name of the inspector and at the bottom of said stencil will be cut the district in which inspection is made. The imprinting from this plate must be with blacking or other durable material, over and across the stamp, and in such manner as not to deface the reading matter on the stamp, that is, so as not to daub and make it illegible. The stamp having been affixed and canceled, it must immediately be covered with a coating of transparent varnish or other substance. Orders for stamps must be made by the inspector on the chief of the Bureau of Animal Industry.

(11) Whenever any package of meat products bearing the stamp of inspection shall have been opened and its contents removed for sale the stamp on said package must be effaced and obliterated from the package.

(12) Reports of the work of inspection carried on in every establishment will be forwarded to the Department by the inspector in charge, on such blank forms and in such manner as will be specified in "Instructions to inspectors of slaughtering establishments."

SWINE.

(13) The inspection of swine for export or interstate trade will be conducted in the same manner as prescribed in the foregoing rules, with the addition, however, that a microscopic examination for trichinæ will be required for all swine products.

(14) When the slaughtered hog is passed into the cooling-room of said establishment, the veterinary inspector in charge, or his assistants, will take from each hog two samples of muscles, one from the "pillar of the diaphragm" and the other from another part of the body, and said samples will be put into a self-locking tin box and a numbered tag will be placed upon the hog from which said samples have been taken and a duplicate number of said tag will be placed in the box with said samples. The boxes containing the samples from the hogs in the cooling-room, so tagged,

will be taken to the microscopist for such establishment, who shall thereupon make a microscopic examination of each box containing samples, and shall furnish a written report to the inspector in charge of the cooling-room, giving the result of said microscopic examination, together with the numbers of the hogs from which samples have been examined.

(15) All hogs reported by the microscopist to the inspector in charge of the cooling-room to be affected with trichinæ will at once be removed from said cooling-room of said establishment under the supervision of said inspector or one of his deputies, and be disposed of by the owner in such manner as may be required by the laws of the State where such factory is situated.

(16) The inspector in charge of the slaughtering or other establishment will issue a certificate of inspection for all carcasses of animals or the food products thereof which are to be exported into foreign countries, which certificate will cite the number of the factory, the name of the owner or owners operating the same, the date of inspection, and the name of the consignee and country to which said articles are to be exported. Said certificate will also contain the numbers of the stamps attached to the articles to be exported. One certificate only will be issued for each consignment. The certificates will be issued in serial numbers and in triplicate form. One copy thereof will be delivered to the consignor of such shipment, one copy will be attached to the invoice or shipping bill to accompany the same and be delivered by the transportation companies to the chief officer of the vessel upon which said consignment is to be transported, and the third copy will be forwarded to the Department of Agriculture for filing therein.

J. M. Rusk,
Secretary.

Meat inspection was instituted under these regulations on May 12, 1891, at the abattoir of Eastman & Co., New York, N. Y., and was confined to the inspection of their export dressed beef. At the beginning of June, 1891, this work was inaugurated in Chicago, and soon thereafter at South Omaha, Nebr.; Kansas City, Mo.; Milwaukee, Wis.; Jersey City, N. J., and Hammond, Ind. Microscopic examination of hogs was commenced at the abattoirs of Nelson Morris & Co., Armour & Co., and Swift & Co., Chicago, Ill., on June 22, 1891.

Since the commencement of this work to October 31, 1891, 1,587,976 animals have been inspected both before and at the time of slaughter. Of this number 1,226,675 were cattle, 25,116 calves, 163,835 sheep, and 172,350 hogs. There were 467,918 quarters of dressed beef tagged for export and 2,818,798 for interstate trade. In addition, 312,683 packages of canned, salted, and smoked meats were stamped in accordance with the regulations.

The following table shows in detail the work of meat inspection from its commencement to October 31, 1891:

Statement showing meat-inspection work from its commencement May 18, 1891, to October 31, 1891.

Character of work.	May.	June.	July.	August.	September.	October.	Total.
Cattle inspected	6,068	77,823	180,243	242,366	338,081	382,094	1,226,675
Beef quarters tagged for export	16,769	50,035	99,783	88,522	113,040	99,769	467,918
Beef quarters tagged for interstate trade		165,378	499,586	583,318	761,180	809,336	2,818,798
Beef carcasses tagged for other establishments		15,050	27,652	110,086	101,165	133,005	386,958
Packages of canned meat stamped		1,594	26,662	45,096	71,922	90,480	235,754
Packages of salted meat stamped		25	861	1,686	5,260	21,180	29,018
Packages of smoked meat stamped		28	768	8,758	16,525	21,832	47,911
Hogs examined microscopically		2,216	9,655	14,650	36,851	108,978	172,350
Packages of salted pork stamped for export					248	1,218	1,466
Packages of bacon stamped for export					329		329
Packages of hams stamped for export					104		104
Sheep inspected			5,766	33,001	54,564	70,504	163,835
Calves inspected				5,233	9,097	10,786	25,116
Export certificates issued	9	30	72	79	165	282	637
Total number of animals whose products have been marked for identification	6,068	79,967	195,311	294,708	437,583	570,446	1,584,083

The workings of this inspection and the carrying out of our regulations were watched with careful scrutiny by the representatives in this country of foreign governments, and the first result of this microscopic examination of hogs was the order made by the German Government on September 3, 1891, removing the prohibition that it had maintained since 1881 against the importation of American pork products. The removal of this prohibition by Germany was followed within a short time by the removal of a similar prohibition by Denmark, and later by Italy, France, and Austria.

The importance of opening the foreign markets once more to an unrestricted importation of American pork products can hardly be overestimated, as affecting the farmers of this country. Prior to the full enforcement by foreign countries of their policy of prohibition, our export trade amounted, in 1881, to $69,000,000 in pork products, excepting lard, which product has never been restricted. In 1891 we exported $50,494,375 in pork products, excepting lard, showing a difference and loss of $18,505,625 between the exports of 1881 and 1891. The exports during the whole period of prohibition averaged about $43,000,000 per annum, and the removal of these foreign restrictions should, therefore, give a market that will increase our export trade in these products at least $26,000,000 a year.

COST OF THE WORK.

It is exceedingly difficult to estimate the cost of the new branches of work undertaken by the Bureau of Animal Industry during the past year. This difficulty is increased by the fact that the amount of work done each month and the cost of the same fluctuate with the demands of commerce for our cattle and their products.

The work of inspection of export animals, provided for by the act of Congress of August 30, 1890, has now been in operation for about twelve months. The average cost of this character of work during this period has been at the rate of $8,500 per month. During certain months it has gone as high as $10,279, and again has fallen as low as $7,400. As an average it might be estimated that the cost of export cattle inspection, which covers the work at interior stock yards, tagging, recording, and inspecting at the foreign animal wharves in Great Britain, would be $100,000 per annum.

The cost of maintaining the supervision of the movement of Southern cattle was at an average expenditure of $2,275 per month, or for the ten months during which these regulations are enforced, $22,750.

The inspection of imported animals arriving in the United States from Canada amounts to $775 per month, or $9,300 per annum.

The work of meat inspection has only been fairly in operation since the commencement of the present fiscal year. The cost of the inspection of animals in this work during the month of July, which includes the examination at time of slaughter, the tagging of quarters of dressed beef going into the export or interstate trade, and the stamping of packages of canned and salted beef and pork products, amounted to $5\frac{7}{10}$ cents per head for each animal inspected, or a total for 195,664 animals in the month of July of $11,160.71. This cost per head was reduced in the month of August to $4\frac{3}{4}$ cents per head, being a total number of 295,250 animals inspected at a cost of $13,981.39. A still further reduction in the cost of this work was accomplished during the month of September, when 438,593 animals were inspected at a cost of

$14,200, an average of 3¼ cents per head. During the month of October the total cost of inspection was $16,392.28. The number of animals inspected was 572,489, making the average cost of inspection 2.86 cents per animal. It seems probable that the inspection of animals and their marking for identification may be accomplished for a sum not exceeding 3 cents per head.

These figures, however, do not include the cost of microscopic inspection of hogs. This latter branch of the work has not been in operation long enough to be properly estimated for. At the commencement of the work it was necessary to educate examiners in the performance of their duties, and some little time was required for their becoming proficient and rapid in their examinations. Another difficulty that has been met with is the fact that several abattoirs which are being supplied with this character of inspection do not keep our examiners supplied with the quota of samples designated in their application for this inspection. The cost of microscopic inspection during the month of July amounted to 20½ cents per hog; during August it was 13⅓ cents per hog; during September, 8⅝ cents, and during October, 5⅓ cents. The number of samples which each examiner should examine in this work is about fifty per day; and, taking this number as the average, the cost of the inspection would be about 5½ cents per animal. It is thought, therefore, that the inspection work undertaken by this Department under the direction of Congress can be made at 3 cents per head for cattle and 5½ cents per head for hogs.

The demand for this inspection by the various packing and slaughtering establishments throughout the country is on the increase. Twenty-two establishments are now having their products inspected, and there are a number of other applicants whose requests have not been complied with, owing to the fact that the appropriation for the Bureau is not sufficiently large to be drawn upon further for this branch of work. It is most earnestly recommended that Congress be asked to make an appropriation for this work sufficiently large to enable this inspection to be extended to all applicants. It might be suggested that this branch of work was not considered by Congress, at its last session, in making appropriations for the Bureau of Animal Industry, as the bill providing for the work was not passed until the closing days of Congress. The benefits which have already accrued by the opening up of the foreign markets to our pork products, the increased demand for beef products, and the reëstablishment of their reputation for wholesomeness and soundness in the markets of the world, together with the protection which inspection gives to our own consumers, justify Congress in providing such an appropriation.

It may be stated in this connection that during the past three or four years considerable agitation has taken place in a number of States relative to the character of animals slaughtered for the interstate trade in dressed beef at the large central abattoirs of the country, and that State legislation was enacted as a police regulation of certain States in order to guarantee to consumers the wholesomeness of the food which was sold for their consumption. This legislation by several States was declared by the Supreme Court of the United States to be invalid, since it was a measure affecting interstate commerce, and belonged exclusively to the General Government of the United States. It is plain, therefore, that the only protection from unwholesome or diseased meat which the citizens of the greater part of the United States can obtain in the present condition of the meat trade must come from the national inspection service. The extension of the inspection and the thorough enforcement of the regulations are consequently matters which interest not only that portion of our people engaged in agricultural pursuits, but to an almost equal degree every citizen of this country.

DIVISION OF ANIMAL PATHOLOGY.

The Division of Animal Pathology, as at present organized, includes all scientific investigations in regard to the nature, prevention, and treatment of animal diseases.

During the summer considerable time had to be spent in fitting up the new laboratory provided for by the last Congress, and in transferring apparatus to it. Though experimental work was not stopped at any time, it was more or less interfered with during July and the early part of August. The new quarters are superior to the old in every particular, and the Bureau is now for the first time provided with all the apparatus and modern appliances which are required for this class of investigations.

The studies of Texas fever have been continued during the summer. The results of the experiments confirm the conclusions of 1890, throwing new light upon the nature of the disease, and strengthening the hope that its means of transmission will soon be fully understood, and the best preventive measures determined.

The work on swine diseases has occupied the attention of the division throughout the year. A Special Report on Swine Plague was prepared with great care, which gives in detail the work done by the Bureau since 1886 in different parts of the country.

Inoculation as a means of preventing the diseases of animals, the different forms of pneumonia in cattle, and tuberculosis are among the subjects which have been carefully studied.

The investigation of animal parasites is being actively prosecuted with reference to our domesticated animals. These parasites are responsible for a large amount of harm, which is becoming more apparent by patient research. The material for a report on the animal parasites of cattle is now being collected.

Other diseases are being investigated as time and opportunity offer, and much valuable work is being done in determining the essential cause of various animal plagues. The results of all the investigations will be published in detail in the reports of the Bureau or in special bulletins.

DIVISION OF FIELD INVESTIGATIONS AND MISCELLANEOUS WORK.

A corps of inspectors is constantly employed in making investigations as to the character, etc., of reported outbreaks of contagious diseases in various States. As an example of the necessity and importance of such work, it may be stated that foot-and-mouth disease has recently been reported as existing in the West, and that this report was cabled to Europe, leading to demands there for the entire prohibition of our live-cattle trade. Upon careful investigation, however, it was demonstrated that the disease in question was not contagious, nor communicable even by direct inoculation, but was due entirely to local causes; and the official statement of this conclusion has been sufficient to quiet alarm and prevent adverse action by foreign countries. There has been less disease of all kinds than formerly among our animals, and happily many of the contagious diseases common or occasional in other countries do not exist at all with us.

This division also maintains a corps of correspondents, the object being to have one or more in every county of the United States, from whom information is collected as to the condition of live stock, the diseases from which this industry suffers, and the various conditions in regard to which the farmers need additional knowledge. This enables the Bureau to keep in touch with the stock-raisers, and encourages them to correspond with it in those cases where it can be of service to them. The division is, therefore, to some extent, a bureau of information, and as such is growing in usefulness as its methods are perfected, and as its employés become more familiar with the wants of the people who apply to it.

This division is also charged with a supervision of the expenditures and accounts of the whole Bureau, a service which is absolutely necessary because of the great extension of the work and the large number of employés stationed in various parts of the country.

QUARANTINE DIVISION.

Stations securely inclosed and provided with suitable sheds, yards, and conveniences for the care of stock have been maintained for the ports of Boston, New York, and Baltimore. Cattle brought to these ports have been quarantined for a period of ninety days from the date of arrival at the station. Although the number of cattle imported during the year has not been large, the quarantining of them has been a necessary precaution to prevent the possible introduction of contagious diseases from foreign countries. The large expenditures which have been made by this country to exterminate such diseases from its borders have made this precaution of special importance to prevent the possibility of the reinfection of the United States.

In addition to the quarantine of cattle, a quarantine of fifteen days has been required upon all sheep and swine brought into the United States at these ports. The number of pure-bred sheep imported has been largely increased over that of other years, which also makes this precaution of detention under veterinary inspection especially important and desirable. When the demand for pure-bred animals is in excess of the supply, the tendency of those engaged in the business is to exercise less care to select only healthy animals and guard them against exposure to disease. The importation then becomes purely a business enterprise, in which many speculators engage with a manifest desire to curtail expenses without especial regard to the ultimate loss which might result to buyers. The need for careful inspection under Government control is, then, more apparent. No important cases of disease have developed in either of the quarantine stations, and the vigilance of the officers of this Department has not been relinquished. The uniformly healthy condition of our flocks and herds in America makes it imperative that a strict oversight should be placed over all animals brought from foreign countries, to prevent the introduction of such exotic maladies as would lead to heavy losses, or possibly ruin an important industry.

PUBLICATIONS.

I take pleasure in calling attention to the great value of, and unprecedented demand for, the Special Report on Diseases of the Horse, written by the most eminent veterinarians of this country, and issued as one of the publications of this Bureau. If we may judge by the character of letters received commending this work, it is within bounds to say that it is one of the most useful publications ever issued by the Government, and that it is worth to the people of the country the entire sum appropriated to the Department of Agriculture for the year. A similar work will soon be issued on diseases of cattle, which it is expected will be of equal value.

The demand for the Special Report on the Animal Parasites of Sheep has continued during the year, and has only been exceeded by that for the Report on the Diseases of the Horse. The preparation of the two volumes just mentioned was, to some extent, a variation from the precedents established in the Department of Agriculture. It was an endeavor to go beyond the monograph, and give the farmer a book of reference on a more extended subject. The unusual success of both publications shows that there is a popular demand for information in this form, and that the monographs alone are not sufficient to supply all the needs of our farmers. There is undoubtedly a field for both classes of publications. The monograph is the best form in which to present new information and the results of original scientific investigations. It is necessary in order to keep the agriculturist abreast with the times. But every farmer must have a wider range of knowledge at his disposal than he can obtain in the form of monographs; and he must have this knowledge classified and condensed if he is to obtain the full benefit of it. It is to supply this want that the volumes of a more general nature are now being issued. The monographs, however, will be continued as the proper form in which to convey new information on each individual topic, and their substance will eventually be incorporated in revised editions of the more comprehensive volumes. The Sixth and Seventh Annual Reports of the Bureau are comprised in one volume, which is now in press, being published by special authority of Congress. A special report on sheep husbandry, prepared with much care, is nearly ready for the printer. A monograph on swine plague has recently been issued, and one on Southern cattle fever, better known popularly as Texas fever, is nearly ready for the press. These two monographs contain the investigations of the Division of Animal Pathology on these subjects, investigations which are so important and comprehensive as to revolutionize previously accepted views in regard to the nature of these two diseases. The material for other equally important reports is being rapidly accumulated. There is a large field of information bearing upon various branches of the animal industry which has heretofore been neglected for the most part in this country, and as a result there is more dissatisfaction and depression in this industry than is justified by the condition of the various markets. It is a period of sharp competition in the markets of this country and of the world, and those farmers can only reach the highest degree of success who are able to avail themselves of all the knowledge bearing upon their business, and particularly of the latest results of scientific investigations.

The following brief account of the investigations conducted under my direction into the nature of the infectious and parasitic diseases of animals, by Dr. Theobald Smith, Chief of the Division of Animal Pathology, and by Dr. E. A. de Schweinitz, contains a review of the more important scientific investigations.

INVESTIGATION OF INFECTIOUS DISEASES OF DOMESTICATED ANIMALS.

By Dr. THEOBALD SMITH.

The work of investigating communicable diseases of domesticated animals has been continued throughout the year at the laboratory and the experiment station.

During August the laboratory was transferred from the attic of the general building to a newly erected house two squares removed. The old quarters had been wholly unsuited to the work, and it was only by patient, persevering labor that the various disadvantages could be minimized in their injurious effect on the work. The great fluctuations of temperature in winter made it impossible to carry on delicate work with the apparatus on hand. In summer the high temperature of the rooms also interfered with certain kinds of work. Lastly, it was undesirable to carry on work with animal diseases communicable to man in the Department building. These difficulties have been largely removed in the new laboratory. This has found a home in a brick building 33 feet wide and 50 feet deep, consisting of three stories and a basement. A boiler in the rear supplies enough power to run a vacuum and an air-pressure pump, besides supplying the building with steam and hot water.

In the basement are kept the smaller experimental animals, so indispensable in the investigation of the causes of infectious diseases as well as of preventive and curative agents. On the first floor are two rooms, one devoted to the study of animal parasites of domesticated animals, and in charge of Dr. C. W. Stiles. The other contains the books, periodicals, and desks of the assistants of the laboratory. The second floor is set aside for pathological and bacteriological work, while the third is devoted to chemical work, and in charge of Dr. E. A. de Schweinitz.

The experiment station, in charge of Veterinarian F. L. Kilborne, has occupied the same grounds since 1884, when it was briefly described in the first annual report of the Bureau of Animal Industry. It has since then been improved by a few necessary wooden structures, in which experiments on large animals, autopsies, and other work which can not be done in the laboratory or away from the experimental animals is carried on. The separation of station and laboratory, though at present unavoidable, causes more or less loss of time, since the work is practically one in both places. It likewise necessitates a more artificial division of labor in the investigation of diseases than is often desirable.

The following pages are devoted to a brief account of the work done during the year, and of the practical inferences which may be drawn therefrom. The complete details of the experiments are passed over to be published when the work has been finished.

As the investigation of infectious diseases is being carried on the world over, it is becoming more and more manifest that their nature is very complex. Each disease has its own special peculiarities, which can be discovered only by prolonged patient research. The discovery of the specific bacteria or other microörganisms belonging to each infectious disease is but the beginning of our knowledge. It then becomes necessary to study the life of these microörganisms, their mode of existence outside of the body, the changes they pass through, and the manner in which they gain access to the body. It becomes no less necessary to study the conditions of the body by which disease is either called forth or prevented. It is necessary, in other words, to find out why certain animals take a disease and others not, and, after we have found out why, to put the susceptible in the same condition as the insusceptible. We either endeavor to vaccinate or else to put them in such healthy surroundings as will enable them to remain well even in the presence of certain disease germs.

These few statements illustrate the difficulty of the subject, and they also indicate that in order to become a successful breeder of animals a certain education is required nowadays, especially with reference to the more common universal facts about bacteria and about disease in general. This education becomes the more imperative, since the growing intercourse between different parts of our own country and between our country and other countries affords an opportunity for the dissemination of new plagues and diseases of whose existence we had no information hitherto. The farmer, through his knowledge of the general laws governing infectious diseases, may thus be able to prevent the occurrence of many otherwise unavoidable calamities.

It must be evident, however, to all unbiased readers that the growth of our knowledge concerning infectious diseases is exceedingly slow, owing to the difficulties to be overcome in investigations. The objects to be investigated are so minute that they stand at the limits of our vision even when armed with the most powerful microscopes which the world to-day produces. The information concerning them is little more than ten years old, and frequently has to be modified after repeated investigation with more exact methods. The facts of one year must be expanded another year, and the practical deductions readjusted. To illustrate this we may cite our experiences with hog cholera. When the bacillus of this disease was first discovered and its life history studied in 1885, it was taken for granted, in harmony with the views then prevailing, that this bacillus would be always the same wherever found. But it was soon determined that it varied considerably in its virulence. Some varieties had so little disease-producing power when inoculated into animals that several new problems arose. Can these attenuated bacilli ever produce disease under natural conditions; and, if they do, what conditions aid them in this work? Not only does the virulence of the disease vary with the variable character of the bacilli, but the character of the disease itself becomes changed. The bacilli are no longer found regularly in the organs where we are accustomed to find them, and thus the diagnosis or the determination of the exact nature of the disease becomes a matter of much labor for the bacteriologist. Similar experiences in investigations of swine plague will be given farther on.

These statements will, it is thought, make plain how our increasing knowledge demonstrates that each disease has features of its own which can not be presumed to belong to other diseases without careful investigation. It will likewise be readily inferred that it is often necessary in collecting our information to make apparently wide excursions from the object to be investigated in order to secure a sufficiently broad and accurate basis for the work to be done. This is not infrequently prepared for us by the investigations of other workers, especially in Germany and France, both in the field of human and animal diseases. But we are as frequently compelled to prepare such a basis ourselves. It thus becomes necessary to extend the work over a period of several years before it is safe to draw any conclusions whatever. It need not be insisted on, therefore, that hasty generalizations may be more injurious than none at all. With these introductory remarks we proceed to a brief review of those subjects which received special attention during the year.

SWINE PLAGUE.

In the course of the year a special report of 160 pages was submitted, which embodied all the investigations which we have had the opportunity to make. In this report the records of the experiments and observations are published in full, and we give now only a brief summary of the practical deductions, which may be of value to those interested in rearing swine.

The investigations had led to the conclusion that there is a disease of swine mainly limited to the lungs different from the cholera. This disease is largely associated with hog cholera, so that it is impossible to estimate what percentage of the losses are due to it. Its distribution seems to be as wide as that of hog cholera. It is caused by bacteria, readily distinguished from hog-cholera bacilli in a variety of ways. These bacteria in pure cultures can be made to produce by inoculation the disease itself in healthy animals. Moreover, the disease is communicable, as was demonstrated in 1890, by placing healthy and diseased pigs in the same pen. The undoubted case of swine plague produced in this way is described in the Special Report, on page 69. The proof that swine-plague bacteria do produce a fatal infectious disease is thus complete, and any further discussion of this part of the subject is useless. The problems which have arisen in connection with this disease, as to its origin, its communicability, its prevalence, its mortality, have been greatly complicated by its frequent association with hog cholera. Nevertheless we have gained some important knowledge which, though by no means complete in itself, is destined to shed light not only on this disease, but on kindred diseases of other domesticated animals.

As far back as 1887 the writer, having studied the properties of the swine-plague bacteria, found them very perishable. The question then arose how they were transferred from animal to animal and from place to place. If they perish quickly in the soil and water by drying, etc., it seemed very likely that they were communicated chiefly by animals themselves. We examined the mouth and throat of various herds of apparently healthy swine, and found in some of them bacteria not distinguishable from those of swine plague, excepting that they were, as a rule, less virulent. We then extended our investigations to other domestic animals and found that in their air passages the same kind of bacteria were frequently present.* In some animals, as in cats, for instance, they were of exceptional virulence. We thus came upon the important fact that in the mouths and upper air passages of cats, dogs, cattle, horses, and pigs, bacteria exist which are practically identical, but which may vary considerably in virulence, or disease-producing power. This implies a wide distribution of this group of disease germs, if it should be found that the same condition of things prevails in different regions and latitudes of our country. We have thus far examined only animals from the District of Columbia and a few Western steers, so that we are not yet entirely prepared to assume a similar distribution over the whole country.

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* See Swine Plague Report, p. 151, for details of experiments.

Given these facts concerning the distribution of this group of swine-plague bacteria and their varying virulence, we may assume as probably true that—

(1) Swine are being constantly exposed to these bacteria by coming into contact with other domesticated animals.

(2) Swine are not likely to be infected by attenuated or but slightly virulent varieties of these bacteria unless the infection is aided by other causes of a debilitating character.

(3) Very virulent varieties of swine plague may produce extensive outbreaks, and hence the same preventive measures are necessary which have been laid down for hog cholera.

(4) In many epizoötics of swine disease both hog-cholera and swine-plague bacteria, as well as the respective lesions of these bacteria, coexist. Such mixed diseases indicate wide distribution of these two kinds of bacteria.

(5) The same group of bacteria produces disease in different domesticated animals, and we may safely assume the occasional transmission of such disease from one species to another.

In the following pages we have endeavored to discuss and illustrate these propositions just laid down. In so doing we are well aware of the fact that they are not yet fully demonstrated. In applying facts of science, it is often necessary to anticipate actual demonstration of a presumed truth, especially when we are thereby put on the conservative side, and our attention aroused to probable dangers in the future.

(1) If we assume that the majority of swine are exposed to swine-plague bacteria in one of the various ways indicated, and that only a small number succumb to the infection, there must exist certain favorable or unfavorable conditions. These pertain either to the animal or to the bacteria, or to both together.

The conditions which make animals more susceptible to infection are as varied as the conditions which reduce their vitality. The importance of rearing and keeping animals in such a manner as to produce and maintain a healthy action of the various functions of the body has not been insisted upon with as much emphasis as it deserves, owing to the somewhat overshadowing influence which the study of pathogenic bacteria has exerted upon all minds. It is evident, however, that veterinary hygiene has much to do with the decline of large epizoötics, not only by keeping away the germs of the disease, but by enabling the animal body to resist their attacks. Of those conditions of swine which invite disease very little is as yet positively known, and we simply call attention to a few to arouse the interest of those who are in position to make observations.

There have been indications during the course of experiments at the Bureau Station that the breed may have some influence in predisposing to infection. As an illustration, we may cite an experiment in vaccination of swine against hog cholera carried on at the station in 1889-'90.* The vaccination, which consisted in subcutaneous inoculation of culture liquid, seems to have had no effect; for, when the time for exposure came, practically all pigs from one lot succumbed and all from another lot survived. The latter were Essex grades reared in pens; the former, grades of mixed Jersey Reds and Chester Whites not raised in pens. While it is impossible to give any facts as to the relative resistance of different breeds to swine diseases, it is a subject which should receive the due consideration of swine-breeders, especially in those States where swine diseases are more or less stationary. Age is another important element. We have found a decided difference in the susceptibility to both hog cholera and swine plague in favor of older swine. This element of age is familiar to all with reference to certain human maladies, such as scarlet fever, measles, diphtheria, and some other diseases which preferably attack the young.

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* Report of the Secretary of Agriculture for 1890, p. 110.

Feeding is perhaps the most important factor in predisposing swine to disease. The assimilation of large quantities of food and its conversion into fat seems to be the one essential function of swine. This goes on to such a degree as to lead to pathological conditions after a time. Not only the ingestion of large quantities of food, but of one kind for a long time, is in itself opposed to the habits of such omniverous animals. Besides overfeeding upon one kind of food we have the uncleanly surroundings in which swine are apt to be kept, contributing materially to the collection and maintenance of bacteria of various kinds, which may be injurious. In addition to the unhealthy modes of existence to which swine are subjected, and partly springing from them, are certain pathological conditions induced by animal parasites of different kinds. The life history of some of the most important parasites infecting swine is still to be elucidated. As a rule, we have found in our post-mortem examinations a larger number and variety of internal parasites in those herds which have been allowed to run freely than those brought up in pens. The opportunities for infection seem to be much greater in the former case than in the latter.

As to the damage done by parasites it is difficult to form an accurate estimate from ordinary observation. Obvious damage may be done in the air passages by lung worms (*Strongylus paradoxus*), and in the small intestine by *Ascaris* and *Echinorhynchus*. The lung worms may be met with in all seasons of the year in swine up to three months old. They invariably inhabit the terminal portion of the two large bronchi of the principal lobes. Here there is generally a partial or total occlusion of the bronchus for 1 or 2 inches from the caudal border of the lobe, due to the lung worms and the enveloping mucus. In some cases the occlusion is followed by collapse and broncho-pneumonia of the lobes supplied by the bronchus and its branches. The hepatized lung tissue assumes a bright or pale red color. When the lung worms are very abundant larger branches of the same bronchus become filled with the parasites, and the broncho-pneumonia may extend over a greater portion of the principal lobes. That lungs in this condition are more susceptible to the invasion of swine-plague bacteria will be generally admitted. The bronchitis, begun where the lung worms mature, may extend after a time into the other air tubes.

Another question arises with reference to lung worms. Do they carry infectious germs into the lungs? This question can not be answered until more is known of the life history of these parasites. Meanwhile the evidence would hardly support the opinion that they introduce the virus. The pneumonia usually begins in the small ventral lobes and travels from them, while the lung worms begin their injurious work in the principal lobes farthest removed from the ventral lobes. All that can be said is that they may make the lungs more susceptible to the disease.

In the intestines *Ascarides* are not infrequently found extending into the common bile duct from the duodenum. Some even enter the gall bladder, while others imbed themselves in the ducts coming from the various lobes of the liver and completely obstruct the flow of bile. The *Echinorhynchus* is well known as attaching itself to the mucous membrane of the small intestine and producing ulcerous depressions, simulating those of hog cholera.

That there may be other predisposing causes at certain seasons of the year, such as obscure malarial diseases due to protozoa, the invasion of the muscular system by psorospermia (sarcosporidia), trichinæ, etc., need simply to be mentioned, since no positive evidence is at hand.

The most important factor in the production of swine plague and hog cholera is the virulence of the bacteria. In the report referred to much experimental evidence is presented to show how much the disease-producing power of swine-plague bacteria from different outbreaks may vary. The same is true of hog-cholera bacilli. It may be laid down as a general rule that the more virulent the bacteria the more severe the resulting epizoötic, and the greater the mortality. While a more attenuated variety of bacteria may spare the older and more hardy animals of a herd, these will succumb to a more virulent variety. Attenuated or weaker varieties of swine-plague bacteria may attack the young and the badly kept swine, those infested with parasites and those of poorer breeds, while the stronger may not become diseased. This may explain also why some herds of swine are destroyed and neighboring ones escape, although both may have had the same opportunities of infection.

How do we know that some of these bacteria have more disease-producing powers and others less? This problem is solved by experimental inoculation of swine and smaller animals. We have already called attention to the various grades of virulence among hog-cholera bacilli. The same statements apply to swine-plague bacteria. In the report quoted, cultures of swine-plague bacteria from Germany were shown to be the most virulent, for they were fatal when only a small quantity was introduced under the skin. Of our own varieties none produced disease when introduced under the skin (excepting in a single case), but it was necessary to inject them into the blood or into the lungs to produce a fatal result.

There is an important practical lesson to be drawn from these facts. Although there may be infectious swine diseases in a given locality which carry off now and then a few animals, such diseases may not become widely distributed because not sufficiently virulent, and particularly well kept herds or certain breeds may escape disease even though exposed to infection. But what is to prevent a very virulent variety of hog-cholera or swine-plague bacteria from being brought into such a locality at any time, of developing into an epizoötic, and sweeping off animals whether old or young, weak or strong? The actual existence of disease should not close the eyes of swine-breeders to even greater dangers due to the importation of still more virulent and destructive varieties of the same disease. In other words, even the constant presence of swine disease should not make the owners of herds careless in the application of preventive measures.

(2) If, then, it is very important to guard against the importation of swine-plague bacteria in diseased herds as having the highest degree of virulence, what are the vehicles by which such swine-plague bacteria are conveyed from place to place?

In the Report on Swine Plague it was pointed out that swine-plague bacteria are far less hardy than hog-cholera bacilli. The former perish rapidly in water and in liquids unsuited to their multiplication. They survive drying for a few days only. In general, they speedily disappear after they have left the body of diseased swine, and it is highly doubtful whether they would survive a month in the soil or in pens. Such agencies as streams, manure, etc., which may distribute hog-cholera bacilli over considerable distances, are of restricted importance in swine plague. The chief danger lies in contact with diseased or infected swine. Intermediate carriers of infection can only act for a short time, while swine may harbor disease germs for months in localized inflammations, such as abscesses under the skin and in the joints and it is possible that they may vegetate on the mucous membranes of the air passages indefinitely.

Swine must thus be regarded as the chief vehicle of infection. This may be conveyed directly from diseased to healthy animals; it may be conveyed by those which have passed through the disease, and hence by older to younger swine. It is safe to assume that any swine which have at any time been exposed to swine plague (or hog cholera) are liable to convey the disease, because we do not know when the specific disease germs leave the body.

Other sources of danger are railroads leaving fresh manure in different places, the vicinity of slaughterhouses, rendering establishments, or any other places where the viscera of swine may be scattered or where numbers of living swine are temporarily housed. If we bear in mind the wide distribution of infectious swine diseases it is easy to believe that in any large herd of swine collected from different localities there are always liable to be some diseased or infected. It is essential, therefore, in guarding against disease, to look with suspicion upon all swine the history of which is not known, to some extent at least.

There is a practice current in some parts of the country of gathering together herds of young pigs from various localities through the intervention of dealers. In regions where swine diseases are prevalent much of the time, and where the virus never dies out, this is a specially dangerous practice. While swine may not be visibly diseased, or may simply appear somewhat unthrifty, they still may carry the seeds of a virulent outbreak within them which need but a little time to gain the required momentum. The mild character of a disease in any one animal is no evidence of the character of the germ; for this mildness may be due to a very virulent germ acting upon a highly insusceptible animal and causing a more prolonged chronic disease. In fact, these partly insusceptible animals are the most likely to appear in the markets, because they are the remnants of herds destroyed by disease. We have frequently been able to demonstrate by experimental inoculations the general accuracy of these statements. Thus, bacteria obtained from inoculated cases in which the disease had taken a more chronic course had not lost any of their virulence. In experiments bearing on vaccination we have been able to increase the insusceptibility of rabbits and guinea-pigs so that virulent bacteria produced only a mild form of the disease, prolonged from days to weeks and even months. Yet the bacteria cultivated from such cases and injected into animals not vaccinated showed no loss of virulence. Again, we have found swine-plague bacteria in swine inoculated two months previously but apparently well at the time of examination, and in case of hog cholera we have found the bacilli in the organs of swine six to seven months after apparently unsuccessful inoculations. These bacteria possessed the original virulence.

The question has frequently arisen in the course of these investigations, Whether the bacteria are ever introduced into herds in the food? This involves another question, Whether hog-cholera or swine-plague bacteria do exist independently of diseased or healthy animals? As to both kinds of disease germs there is at present no evidence to show that they live outside of the animal organism, except temporarily, and that, if the food happens to be infected, the infection has come from animals directly or indirectly, and that it is simply a question of time whether such infection is still in a living condition or not. Food, however, may be infected with other pathogenic bacteria which may become dangerous in producing secondary and perhaps fatal lesions in animals already diseased.

(3) We have repeatedly called attention to so-called mixed diseases in which both hog-cholera and swine-plague bacteria are found. This can only be explained by a wide distribution of both hog-cholera and swine-plague bacteria. The practice, already alluded to, of purchasing pigs from many herds and localities and bringing them together to be fattened as one herd is the most successful method of bringing various grades of pathogenic bacteria together and of producing a mingling of two diseases. These mixed outbreaks may develop in other ways also. The disease may begin as hog cholera and become subsequently complicated with swine plague, or the reverse may be true; the disease may begin as swine plague and become complicated with hog cholera. In either case the most virulent variety will probably start the disease, and any attenuated hog-cholera or swine-plague bacteria, which are latent in some of the animals of the herd or have not yet been killed out of the soil and the surroundings from a former outbreak, may start into activity and thus produce a more fatal mixed disease. It is evident that such secondary attacks of attenuated bacteria would not take place if the animals had not been weakened by the primary disease. This may be the only way in which the great majority of the swine-plague bacteria in the air passages of healthy animals can exert any pathogenic effect whatever. It is equally difficult to understand how attenuated hog-cholera bacilli can act without assistance from swine plague unless we accept such an explanation as the following: In swine plague some cases are usually of a more chronic type. The disease lasts some time, and is associated with caseous changes in the lungs. Any hog-cholera bacilli have thus abundant opportunity to enter the weakened organism through the diseased lungs, for instance, and appear after death in cultures from the internal organs. For the same reason hog-cholera outbreaks characterized by very feeble pathogenic activity of the hog-cholera bacilli, and hence of a more prolonged duration and chronic character, are usually complicated with swine plague, because the latter, even though of a feeble activity, has been able to invade the weakened organism and has had time to do so. In virulent outbreaks of either disease death may ensue so rapidly that no invasion of the other disease takes place. These statements presuppose, of course, that both kinds of bacteria exist in the surroundings of the herd.

There are no facts at hand to indicate any difference in the distribution of these two plagues. The localities where either one or both plagues have been determined by bacteriological investigations may be tabulated as follows:

Locality.	Character of plague.	
By the Bureau of Animal Industry:		
District of Columbia, numerous outbreaks, 1885–'90	Hog cholera	Swine plague.
Maryland, various outbreaks, 1885–'90	do	Do.
Virginia, various outbreaks, 1885–'90	do	Do.
Nebraska, 1886	do	
Illinois (Geneseo), July, 1886		Do.
Illinois (Sodorus), September, 1886	Hog cholera	Do.
Illinois (Ottawa), November, 1891	do	Do.
Iowa, December, 1886		Do.
Iowa (Mason City), November, 1888	*(?)	Do.
New Jersey (Johnsonburg), October, 1887	†(?)	
New Jersey (Pleasantville), July, 1890	(?)	Do.
Missouri (Chillicothe), 1890–'91	Hog cholera	Do.
Nebraska (1886–'88), by Billings	do	(?)
Maryland (Baltimore), by Welch and Clement	do	Swine plague.
South Carolina, by Bolton	do	
Illinois, by Burrill		Do.
Kentucky, by Burrill and Shakespeare		Do.
Massachusetts (near Boston), by J. A. Jeffries		Do.

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*The investigation in Iowa did not bring to light any hog-cholera bacilli, though the lesions suggest the presence of attenuated forms not accessible by the usual methods.

†In this small outbreak bacilli closely resembling those of hog cholera were found in the spleen. Their virulence, however, was very feeble. Subcutaneous inoculation had no effect on rabbits.

(4) The question whether the different species of domesticated animals on a farm may take from or transmit to swine the disease which we have been considering is of very great importance in view of the changing conditions of live-stock interests, which are going on in different directions in various parts of our country.

The problem may be stated as follows: Has the bringing together of different species of animals for the purposes of feeding, etc., on the same ground, a tendency to increase disease in one or the other species? Will swine take swine plague from cattle, and will they transmit it to sheep and horses, for example, or is the reverse ever observed?

Investigations and observations during the past thirteen years lend some color to such possibilities, and it becomes necessary at least to call attention to those engaged in raising and keeping farm animals to what has been determined in this direction, and to arouse their interest in the investigation of outbreaks of swine plague, especially as regards the immediate causes.

In the summer of 1878 there appeared in three royal game preserves, in the vicinity of Munich, in Bavaria, a very fatal epizoötic among the wild boars and deer, of which 234 boars and 153 deer perished.* It was also noticed that even after the plague in the parks had apparently died out, disease among cattle in the neighborhood appeared, and this, according to the observations of veterinarians, was identical with the disease observed among the game in the parks.

The disease was very acute, lasting from twelve to thirty-six hours in the majority of cases. The chief lesions were croupous pneumonia, pleuritis, pericarditis, and mediastinitis. In cattle the disease appeared in two forms. In one a swelling was observed on the head, the face, the neck, or in the tongue, which assumed enormous proportions in six to twelve hours, and led to suffocation. The swelling was due to serous or serous and hemorrhagic infiltration. In the other form, in addition to the pneumonia, pleuritis, and pericarditis observed in the game, there was always present a severe hemmorrhagic inflammation of the small intestines. At this time bacteriological methods were still undeveloped, and nothing is known of the nature of the bacteria causing this outbreak save the fact that they were not anthrax bacilli. A number of inoculations were made upon various animals, which testify to the extreme virulence of the specific bacteria.

Rabbits died six to eight hours and sheep and goats thirty to thirty-six hours after inoculation. Two old horses died after subcutaneous inoculation with blood from cattle in a very short time. A young steer one and one-half year old was fed with a thimbleful of the intestinal contents of a calf which had succumbed to an enormous swelling. The steer died in fifty-four hours with pneumonia and pleuritis. A pig inoculated subcutaneously over the left shoulder with a few drops of blood died in twenty-two hours. Besides an extensive erysipelatous swelling starting from the point of inoculation there was beginning fibrinous pleuritis.

The disease reappeared in the following years, either sporadically or in restricted outbreaks. In 1879 and 1880 it was observed among domesticated animals alone; in 1881 among the animals in the game preserves. In 1885 Kitt† published some investigations which were destined to throw more light upon this new plague. With blood from an outbreak among cattle resembling the epizoötic described by Bollinger, Kitt made some inoculations upon small animals. Of mice, rabbits, guinea-pigs, and one pigeon inoculated, the mice and rabbits died within twenty-four to thirty-six hours, the pigeon in thirty-six hours. The guinea-pigs were not affected. Lesions were in general absent. The blood contained large numbers of bacteria. Subsequently the spleens of an ox, a young pig (of which eight had died), and a horse which had succumbed in the same locality, showed on microscopic examination the same bacteria, whose virulence tested on rabbits was likewise the same. In a cow inoculated subcutaneously over the left shoulder an extensive inflammatory œdema of the inoculated shoulder appeared, which extended over the entire left limb. The swelling later became converted into an abscess, but the animal did not die.

Of special interest is the subcutaneous inoculation of a pig with a minimum quantity of mouse's blood. From the place of inoculation on the right thigh a bluish discoloration of the skin spread over the whole body in spots and patches, while there was considerable swelling at the place of inoculation. The pig was dead in twenty-four hours. The autopsy revealed, in addition to the lesions mentioned, exudative pleuritis and peritonitis, congestion of the mucous membrane of the upper air passages and of the stomach. A goat inoculated subcutaneously in the same manner was afflicted with extensive local inflammatory œdema and died within two days. A horse inoculated subcutaneously in the neck with a suspension from an agar culture, derived originally from the mouse, died within one and one-half days with extensive local reaction, fluid blood, ecchymoses on heart, pleuritis, and pericarditis, and beginning inflammation of the mucosa of the stomach. The bacteria found by Kitt have a marked resemblance to swine-plague bacteria, and their pathogenic effect on pigs and smaller animals is identical with that of very virulent swine-plague bacteria.

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* Bollinger. Ueber eine neue Wild- und Rinderseuche. München, 1878.

† Ueber eine experimentelle der Rinderseuche (Bollinger) ähnliche Infectionskrankheit. Sitzungsberichte der Gesellschaft für Morphologie und Physiologie in München, I, 1885, s. 140–168.

A disease probably identical with the foregoing was described by Oreste and Armanni,* as occurring among herds of young buffaloes in Italy. The disease appears very suddenly, and the animals attacked may die in from twelve to twenty-four hours. The symptoms are high temperature, rapid and feeble pulse, discharge of mucus from nose and mouth, associated with a local swelling on the head and face which leads to suffocation. The specific bacteria seem to be identical morphologically with swine-plague bacteria. The disease can be reproduced in young buffaloes by inoculation of cultures. It was similarly produced in a colt, a cow, a sheep, and in mice, rabbits, guinea-pigs, pigeons, and fowls. Death ensued in all animals in from one to three days. Of two young pigs inoculated one died, the other survived.

In France, Galtier† has found pneumo-enteritis of swine associated with a similar disease in sheep which came into contact with them. While there is much in favor of his assumption that the infection passed from the swine to the sheep, the description of the specific bacteria and of the methods of inoculation are not sufficiently complete and thorough to bring conviction as to the transmission, or furnish any definite information concerning the nature of the bacteria found. A few suggestions thrown out here and there are sufficient, I think, to permit us to exclude hog-cholera bacilli and regard them as belonging to the group under consideration.

These various investigations are of great importance in showing that some infectious diseases may either attack several species of domesticated animals at the same time, or be inoculable from one species to another. What is of special significance in the first two investigations is the extreme virulence of the bacteria. The same may be said of the Italian buffalo disease. The bacteria causing these outbreaks are, so far as it is possible to ascertain from the descriptions, all members of the swine-plague group of bacteria.

There is another class of infectious diseases due to bacteria of the same group, which produce specific diseases among certain species of domesticated animals, but which diseases are not known to be communicable to other species. Among these are fowl cholera, rabbit septicæmia, and a peculiar form of pleuro-pneumonia in cattle, which Poels has called "septic pleuro-pneumonia." During the past three or four years the writer has examined in the laboratory of the Bureau of Animal Industry a small number of lungs from cattle affected with pneumonia, from which bacteria practically identical with swine-plague bacteria were isolated. A description and discussion of these forms of pneumonia in cattle will be reserved for a future report.

There is thus a wide distribution of diseases among domesticated animals due to a group of bacteria closely resembling and probably identical with swine-plague bacteria. Some diseases attack several species at the same time; others are, so far as we know, restricted to one species. We have also seen that there is a wide distribution of attenuated varieties among the same domesticated animals in the healthy state, inhabiting, so far as our investigations have gone, the upper air passages. Some observers are inclined to regard these different bacteria as practically the same. Hüppe has proposed the name

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* Atti del R. Instituto d'incoraggiamenti alle scienze naturali, etc., 1887. For a brief account see also Journal de Médecine Vétérinaire, 1887, p. 585, and Baumgarten's Jahresbericht for 1887, s. 124.

† Journal de Méd. Vét., 1889, *passim*.

Septicæmia hæmorrhagica for all the forms of disease caused by them. Other observers hesitate to accept at present this unifying explanation. For practical purposes the following explanation, based on quite extended study of this group of bacteria, may serve as a provisional guide in the prevention of disease:

The real test of the power of any bacteria to produce disease is virulence. The greater the virulence the more liable will be the disease to spread from one species to another. This is strikingly illustrated by the *Wildseuche* of Bollinger. The relative virulence can be accurately determined only by careful series of inoculations upon small and large experimental animals, performed in precisely the same way in each case with pure cultures of the bacteria. Again, the power of a given disease to pass from one species to another frequently remains unnoticed, partly because in many cases there is not sufficient opportunity for such transmission. The nature of food required for each, and other conditions lead to specialization in stock-raising, and tend to restrict each species to its own pasture ground.

It is not unreasonable to suppose that bacteria living in the air passages of one species, and harmless to it to a certain degree, may prove to be disease germs with reference to another species. Thus the attenuated bacteria living in the air passages of healthy cats, dogs, pigs, and cattle are all fatal to rabbits and some to pigs. In general the larger and more powerful the animals the less effect disease germs have upon them. It is, therefore, possible that some of the outbreaks of swine disease in the Western States may be due to the cattle with which the swine are herded for feeding purposes. The bacteria in cattle, harmless to them, or perhaps causing only mild disease and rarely observed, may prove the starting point of disease for swine.

While we have no positive demonstration of these statements, it is desirable that those engaged in stock-raising should have their attention called to the possibilities embodied therein.

(5) In regard to the general measures to be taken and the rules to be observed in the prevention of hog cholera and swine plague, we refer the reader to the Report of the Secretary of Agriculture for 1888, page 156, or the Report of the Bureau of Animal Industry for 1887–'88, page 148, or the Special Report on Hog Cholera, 1889, page 123. The rules and directions there formulated are adapted as well to swine plague, for the bacteria of the latter disease are even more easily destroyed by various agencies than are hog-cholera bacilli. In the following pages only the most important points are touched upon.

The things with which healthy swine should not come into contact are, in the order of their importance, first of all, diseased herds and animals, strange swine the history of which is not known, offal from establishments using carcasses of swine, recently infected ground, railroads carrying swine, and polluted streams. Soil and water may be infected by living and dead swine or any offal from them.

When the disease has actually appeared in a herd the question generally arises whether it is worth while to make any attempts to save a portion of the herd or to leave them to their fate. As a rule it may be stated that it is best to slaughter both healthy and diseased at once, and give the surroundings sufficient time to rid themselves of the infection before fresh animals are brought into them. If this be not desirable we should recommend the following measures to be rigorously carried out:

(*a*) Removal of still healthy animals to uninfected grounds and pens as quickly as possible.

(*b*) Destruction of all diseased animals.
(*c*) Careful burial or burning of carcasses.
(*d*) Repeated thorough disinfection of the infected premises.
(*e*) Great cleanliness both as to surroundings and as regards the food.

If the animals have been removed to uninfected grounds, careful watching is necessary to remove therefrom at once all swine which show signs of disease.

Among the various disinfectants which can be recommended are the following:

(1) Slaked lime, in the proportion of about 5 per cent (one-half pound of lime to a gallon of water).

(2) Equal volumes of crude carbolic acid and ordinary sulphuric acid mixed together and added to water in the proportion of 2 ounces to a gallon of water (1½ volume per cent).

(3) Sulphuric acid, added to water in the proportion of 1 ounce to a gallon.

(4) Boiling water.

(5) Corrosive sublimate (mercuric chloride), in the proportion of 1 drachm to a gallon of water (1 to 1,000).

Solution No. 2 is said to be more active if, while the sulphuric acid is being added to the crude carbolic acid, the vessel containing the latter is placed in cold water to prevent undue heating of the liquid.

It should be borne in mind that sulphuric acid and corrosive sublimate attack metals, and that the solutions are best made in wooden pails, etc. Corrosive sublimate is also highly poisonous, and the solution should not be made stronger than indicated. The lime is, on the whole, the best and cheapest, but it may not be desirable to use it everywhere; hence one of the others may be substituted. Each of the solutions recommended is more than strong enough to kill hog-cholera and swine-plague bacteria and they need not be increased in strength.

When swine have become infected while running over tracts of ground, disinfection of such tracts may be regarded as practically impossible. If, however, they have been brought up in pens or in small inclosures, disinfection should be thoroughly carried out. The woodwork of pens may be disinfected by exposing all portions, cracks and corners, to the action of any of the solutions mentioned. These may be applied with a broom or any other household article which insures uniform wetting. Whitewash is useful for woodwork of fences, etc., when there is no objection to its appearance. Its action is only exerted at the time of application, and after it has dried it will not destroy bacteria subsequently adhering to it. It must, therefore, be applied fresh every time disinfection is needed. For large farms some kind of spraying apparatus would be of great service in insuring uniform distribution of the disinfectant. In the selection care must be exercised, however, owing to the corrosive action of some of the solutions. The disinfection of the surface of the soil over small areas is perhaps best accomplished by the slaked lime or the crude carbolic-acid solution. It should be remembered that both preparations may be irritating to the feet of animals immediately after they have been applied. The feeding troughs should receive special attention, and after the application of the disinfectant this should be washed away with water, preferably hot or boiling.

The directions thus far given apply mainly to the prevention of disease. When animals have been actually attacked, can anything be done for them? It has already been stated that treatment of communicable diseases is not a desirable thing, but even if it were the deaths follow each other so rapidly in many outbreaks that there is no time for the application of remedies. If, however, an effort to treat them is to be made, it is desirable to avoid the various specifics and remedies of unknown composition, some of which, thoroughly tested at the Bureau Station by Dr. F. L. Kilborne, were of no avail in checking the disease. The sick animals should be isolated one from another, as far as possible confined in small inclosures, kept quiet, and fed with moderate quantities of food, preferably with milk, if this is to be obtained. If the swine are being fattened when the disease appears, this process should be stopped at once and a light diet substituted. The tendency towards the localization of disease in the large intestine, in both swine plague and hog cholera, seems to be due, at least in part, to the constipated habits of the pig, which permit the pathogenic bacteria to remain long enough in the intestine to act injuriously upon the mucous membrane. Constipation is not easily overcome, as the trials with various cathartics have demonstrated, and it is highly important when the disease has appeared to feed a greater variety in small quantity or to follow the recommendation of giving the digestive organs a complete rest by feeding milk. The boiling of food may be desirable, inasmuch as it destroys any disease-producing bacteria which may be present, and makes digestion easier. An experiment carried out at the Bureau Station with boiled food did not show any more favorable results, however, than with unboiled food ordinarily given, so we can simply suggest it for further trial.

Even if treatment should succeed after much trouble and expense to save some few swine, it may not be profitable, owing to the injury inflicted on the various organs during the disease. The lungs are, as a rule, seriously affected. They may become adherent to the walls of the thorax, and the pericardium may become thoroughly attached to the heart and impede its action. These permanent injuries, which no kind of treatment yet suggested can avoid, exercise an injurious influence on the proper development of the animal affected, and make its raising of questionable advantage. It has already been stated that such recovered animals may, for a time at least, be dangerous as carriers of the disease germs to other swine.

The only encouraging line of action, therefore, lies in the prevention of disease by the observance of suitable precautionary measures, and in that general practice of hygienic laws which thus far has been the only means of checking the rapid spread of epidemics in the human family. The methods first suggested by Pasteur of inoculating animals with attenuated cultures to make them resist any and every attack of a given infectious disease is, theoretically considered, the simplest means of prevention. Practically, however, there are two general objections which are growing in importance year by year, as our knowledge of infectious diseases is becoming broader and deeper. The method of Pasteur may distribute the specific bacteria far and wide and become a source of future evil, since we do not know but that the attenuated bacteria may in some way regain their former virulence. The other objection rests on the fact that diseases differ so much one from the other that the method seems to insure success in only a few diseases of a certain character. Provided the animals are actually protected by inoculation, the first objection might be set aside in regions in which the disease prevails at all times.

As regards swine plague, the experiments which have thus far been carried out indicate that this disease may prove amenable to preventive inoculation. We have been able, by the injection of both living cultures and those sterilized at a low temperature (58° C.), to make the most susceptible animals, rabbits, insusceptible to the most virulent swine-plague bacteria. By two subcutaneous injections of cultures of swine-plague bacteria, swine have been made insusceptible to doses injected into the circulation, which proved fatal to "control" pigs within twenty-four hours. In the preliminary experiments upon rabbits, designed to produce immunity, several methods were employed.*

(1) Minute but gradually increasing quantities of culture liquid of very attenuated swine-plague bacteria were injected at different intervals into the ear vein of rabbits. Only a very small proportion of these survived the test inoculation with very virulent swine-plague bacteria.

(2) Sterilized bouillon cultures were injected into the abdomen and into the circulation of rabbits. This method also produced immunity and partial resistance, but in only a comparatively few animals.

(3) The preceding method was modified in the following manner: Swine-plague bacteria from outbreak IX were allowed to produce for two days a rich growth upon agar. This growth was scraped off and a very turbid suspension of bouillon prepared and sterilized at 58° C. With this sterilized suspension injections were made into the abdomen of rabbits as follows:

Rabbit No.	May 4.	May 8.	May 14.	May 22.	Total.	Remarks.
	cc.	cc.	cc.	cc.	cc.	
35	1.5	1	2	3	7.5	Inoculated with virulent swine plague, May 26. Check dies over night. All three survive with considerable local reaction.
36	2	.5	2	3	7.5	
37	1	1.5	2	3	7.5	
38	.5	2	2	....	4.5	Inoculated with virulent swine plague, May 19; dies in 6 days with severe local reaction, pleuritis and pericarditis. The check dies in 16 to 20 hours.

These results show very decisively the protective effect of the sterilized growth of swine-plague bacteria. Additional experiments have not yet been made. In conjunction with Dr. Kilborne, the protective effect of swine-plague cultures was tested upon swine in the following experiment: Seven pigs belonging to the same lot and about four months old were chosen, three of which were set aside as "control" animals or checks. The remaining four received, February 28, 1891, a subcutaneous injection of 6 cubic centimeters of peptone-bouillon culture of virulent swine-plague bacteria, one-half into each thigh. As a result one died. The remaining three were reinoculated in the same way March 14, receiving on this date 10 cubic centimeters of culture liquid. April 3, these, together with the three control animals or checks, received the final test inoculation; 2 cubic centimeters of peptone-bouillon culture of the same bacteria were injected into a vein of the leg of each animal. Two of the control animals died within twenty-four hours, the third in thirty-six hours. None of the three vaccinated animals became ill. No symptoms of disease or lesions appeared subsequently.

These experiments simply demonstrate the fact that swine may be protected from fatal doses by subcutaneous injection. Whether this process would be successful in natural outbreaks can not be inferred from this test alone.

TEXAS FEVER.

During the past summer most of the available space at the Bureau Station was taken up with field experiments in Texas fever. The work in connection with this disease extended from the first week in July until the middle of November. The busiest season extended from the middle of August to the middle of September, during which time the disease makes its appearance in the exposed cattle. The field experiments were mainly directed by Dr. F. L. Kilborne, while the writer devoted himself to the study of the blood parasite of the diseased cattle and problems connected with the direct transmission of the disease from diseased to healthy cattle and other domesticated animals. In this work he was assisted by Dr. E. C. Schröeder, who did most of the counting of blood corpuscles—an indispensable process in determining whether exposed animals have taken the disease or not. The study of preparations of blood obtained from diseased and healthy cattle has been continued in the laboratory more or less throughout the year.

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* These experiments were carried out in conjunction with Dr. V. A. Moore.

In all thirty cases of Texas fever came under observation, of which seven died. The small percentage of fatal cases was very probably due in part to the coolness of the summer, in part to the fact that some of the animals had passed through the disease the previous year. In addition, a number of healthy animals were kept under observation as controls to the experiments. The investigations were directed mainly to the relation of ticks to the disease, although other problems were likewise under consideration, as will be seen below. The work consisted in taking the temperature and carefully examining the blood of the various cases from time to time to watch the beginning and the course of the disease in those exposed. This is absolutely necessary, otherwise nonfatal cases may entirely escape attention.

(1) The work of the past summer has again amply confirmed the work of previous summers, that the true cause of Texas fever is a microscopic parasite, belonging to the protozoa, which lives within the red blood corpuscles and destroys them. This protozoan has been detected in all cases of the disease coming under observation during the summer. In some instances the number of red corpuscles infected with this parasite in the kidneys, for example, was nearly 100 per cent. Bacteria have not been seen in any case unless post mortem decomposition had begun. We therefore see no ground for the supposition that Texas fever is a bacterial disease, as has been maintained by Billings and Paquin, unless the disease studied by them in the West differs from the one produced at the experimental station by North Carolina and Texas cattle. Such an assumption is hardly allowable when we take into consideration the identity of symptoms and lesions.

(2) It has already been stated in the Report for 1890 that when ticks are hatched from eggs and placed on cattle they will produce Texas fever. This very important discovery was confirmed during the past summer by producing with young ticks the disease in three animals. One of these died, the others recovered after a time. Not only was the disease called forth in this way, but it was produced before the disease broke out in the field in which Southern and native cattle had mingled for some time. Thus the Southern and native cattle were placed in the same inclosure July 2, and the disease was first noticed August 22. The disease produced artificially by ticks alone in another inclosure appeared August 8. Both cattle and ticks were brought from North Carolina at the same time. The difference was due to the fact that in the one case the tick-eggs were hatched artificially in the laboratory and thereby the process hastened.

During the winter of 1890-'91 a portion of one of the barns on the experiment station grounds was kept heated by means of a stove and the tick experiments continued. About six animals were used. A variable number of young ticks hatched in the laboratory were placed on these animals at different times. In all natives the disease was produced. In all but one it was exceedingly short and mild in duration. In this one the disease was identical with the nonfatal autumnal form of the disease, which differs clearly from the acute and usually fatal midsummer type, as will be shown in the detailed report. The object of these experiments was to determine whether cattle could not be subjected to a mild winter disease and thereby be made insusceptible. The results of the experiment did not, however, come up to our expectations.

In the work of the summer the question whether there are any other agents besides ticks which may convey the disease, being the most important of all under consideration, was again tested. The experiment consisted in picking ticks from Southern cattle before they were brought in contact with native cattle, and afterward examining them every day to remove any which, in the first instance, had been too small to be detected. For this purpose Dr. Kilborne proceeded to North Carolina to procure suitable animals, and on their arrival no time was lost in removing the ticks and placing them with natives in the same inclosure. In 1889 a similar experiment had proved successful, *i. e.*, the exposed natives remained free from disease, but owing to the fact that the method of detecting very mild attacks by blood examination had not been fully worked out at that time it was highly desirable to try this experiment over again. A similar experiment was carried on in 1890, but it failed because the ticks had very probably been washed in from an adjoining more elevated field by the unusually heavy rains of the season. Last summer, also, the experiment was only partially successful for the reason that a few ticks had evidently escaped attention. On the exposed cattle a small number of ticks appeared in due time and two out of three took the disease. By carefully removing the small ticks from all three cases one animal was probably saved from infection, at least it did not take the disease. Of the two remaining, one finally died; the other recovered. While this experiment does not therefore prove that ticks are the only bearers of the infection, it is not opposed to this theory but rather in favor of it, as is shown by the experiment which had been going on in another field at the same time. In this field the ticks had not been removed from the Southern cattle, and as the young ticks appeared on the natives in due time in very large numbers, none of the exposed natives remained free from Texas fever.

(3) Can Texas fever be transmitted from sick to healthy cattle by direct inoculation? This question may now be answered in the affirmative. Last year blood from diseased cattle was injected directly into the jugular veins of two healthy animals. Subsequent examination indicated a mild attack of Texas fever, but the result was not positive enough. This year the blood of a diseased animal was injected into the jugular veins of three healthy animals, and in all a very acute form of Texas fever was produced within four or five days after the injection. One of these died, the others recovered. There can be no doubt, therefore, that the disease is inoculable when the germs are transferred quickly from the blood of one animal into the blood of another. As an illustration, a few brief notes of the fatal case are appended:

No. 186.—Cow 10 to 12 years old, from Maryland. Received on the station September 4, and placed in an unused field at some distance from the infected inclosures.

September 8.—Temperature, 102. Red blood corpuscles, 4,980,700. Animal in good condition.

September 19.—After a careful examination of the blood, 14 cubic centimeters of blood, taken from the jugular vein of a cow affected with the disease, is injected into a jugular vein of this animal.

September 20.—Temperature, 100.8.

September 21.—Temperature, 8 a. m., 100; 5 p. m., 103.

September 22.—Temperature, 8 a. m., 100.4; 5 p. m., 103.4.

September 23.—Temperature, 8 a. m., 102.6; 5 p. m., 104.7.

September 24.—Temperature, 8 a. m., 101.6; 6 p. m., 105.

September 25.—Temperature, 7:30 a. m., 104.3; 2:30 p. m., 106; pulse, 72; respiration, 78; red corpuscles, 4,761,900. Several large amœbiform parasites within corpuscles.

September 26.—Temperature, 7:30 a m., 106; 2:30 p. m., 107; pulse, 96; respiration, 108; corpuscles, 4,330,000. Pairs of large amœbiform parasites within the corpuscles detected in both fresh and stained preparations of blood.

September 27.—Temperature, 6:30 a. m., 104.6; 6 p. m., 105.8.

September 28.—Temperature, 7:30 a. m., 102.2; 2:15 p. m., 101.2; pulse, 108; respiration, 60; corpuscles, 2,123,000. In one preparation fully 10 per cent of the corpuscles were infected with parasites. Animal exceedingly weak and trembling. Can scarcely remain standing. Falls and remains down, unable to rise. As the blood contained a considerable number of parasites, some was withdrawn from a jugular vein for the inoculation of some small animals. After this the cow went into convulsions and died a few minutes later.

At the autopsy the heart was found ecchymosed, the spleen very much enlarged and softened ($4\frac{8}{16}$ pounds); the liver enlarged, and occasional spots of bile injection visible on section. The bile was greatly thickened with flocculi and the urine contained hæmoglobin (red water). The parasites were present in the internal organs in large numbers. From cover-glass preparations the following estimates were made.

In blood from subcutaneous vein, 1 to 2 per cent of corpuscles infected.

In blood from right ventricle of heart, 1 to 2 per cent of corpuscles infected.

In blood from heart muscle itself (capillary blood), 30 to 50 per cent of corpuscles infected.

In blood from the spleen, 10 per cent of corpuscles infected.

In blood from the liver, 20 to 30 per cent of corpuscles infected.

In blood from the kidneys, nearly 100 per cent of corpuscles infected.

The parisites were chiefly in pairs.

(4) We have thus shown (1) that ticks placed on cattle soon after hatching produce Texas fever; (2) that blood taken from a sick native and injected into another native may produce the acute type of Texas fever without the intervention of ticks. In other words, the disease is inoculable from one native to another. The question next presents itself: Is the disease ever transmitted by natural agencies from Southern to native cattle and from sick to healthy natives without the aid of ticks? A full discussion of this important question would be premature at the present time, inasmuch as experimental evidence alone can solve the problem, and this is not yet forthcoming. It may, however, be excusable to say a few words on this phase of the subject, since the experimental work, being restricted to a few summer months, is necessarily slow in progress from year to year.

It is highly probable that the ticks are the only agents which carry Texas fever to Northern pastures. This is borne out by the long period of incubation (five to six weeks), which corresponds precisely to the time necessary for the development of a new generation of ticks. This was discussed in last year's report, and it was there pointed out that this long period was due to the fact that the mature ticks as they dropped on the pastures from Southern cattle laid their eggs, that these eggs hatched in from two to three weeks, according to the temperature, and that then the young attacked native cattle. The disease appears in from ten to fifteen days after the young ticks have attached themselves to native cattle. The production of a new generation of ticks necessarily demands four to five weeks, and thus corresponds to the original so-called period of incubation. The actual period of incubation, that is, the time elapsing between the infection of the blood by the tick and the first appearance of fever, is probably not more than five days.

When the disease has appeared in a herd, can any transmission of disease from sick natives take place? We have referred to this matter in the preceding report, and pointed out that sick natives with ticks on them may, after thirty or more days, infect pastures with a new generation of young ticks. But this usually pushes this infection into the late fall, and the disease thereby produced is mild and may pass unnoticed. But another question here presents itself: May the disease be transferred more speedily and directly than by means of young ticks from sick to healthy natives? This question is of little practical importance when the natives are all exposed in the original infected field, as the young ticks are there all summer, and hence all cattle are likely to become infected sooner or later. But when diseased animals are taken from such infected fields and placed in noninfected inclosures, may healthy animals be infected directly from them? This infection must be considered possible through the agency of flies which pass from cow to cow, sucking their blood and thus inoculating the disease, because we have shown that the disease may be induced by the injection of diseased blood. But such mode of infection must be considered exceedingly rare, as we have observed it but once during the past three summers, and even in this instance the case is by no means clear.

In one of the inclosures on the experiment station, removed by a field and a lane from infected grounds, a number of head of cattle were kept as a reserve for experimental purposes. On September 29, over a month after the disease had appeared in the regularly infected pasture, a cow in this field died of undoubted Texas fever. This occurrence led at once to an examination of the blood and the temperature of the remaining animals in the field. Only one other was found infected. Upon this cow venesection had been practiced repeatedly early in the summer to elucidate some questions bearing on the blood in Texas fever, and she had been examined September 8 and found healthy. No ticks could be found on the animals in the inclosure. Here seems to have been a transmission of Texas fever without ticks. How the disease was transmitted will of course never be known. It is possible that flies may have passed rapidly from one field to another carrying the infection on their mouth-parts and inserting it into the vessels of the skin of healthy animals. This mode of infection from one field to another is regarded as very rare by those who have had occasion to watch the disease.

It will thus be seen that the facts are greatly in favor of the tick as the sole agent in the transmission of disease from the permanently infected regions of the South to Northern pastures. This will be still clearer when the subject is more fully presented with the experimental evidence. Meanwhile it would be unwise to deny the possibility of occasional infection of Northern animals mingling with those from the South through the agency of flies, etc., when there are infected and diseased animals in the Southern herd. Such transmissions would not affect pastures, but only the animals accidentally infected.

(5) That ticks may live through mild winters in protected localities and give rise to disease in the following summer without any fresh importations from the South was demonstrated on the station during the past summer. This is an exceedingly interesting and important point for latitudes whose climate resembles that of Washington, and should not be lost sight of by those who may be investigating the source of any particular infection. In September of 1890 ticks hatched in the laboratory were placed on two cows in a piece of woodland belonging to the station, but some distance removed from it. These contracted the disease in due time. One died during the acute attack, the other succumbed after it. The ticks matured from this case wintered over probably among the leaves under the trees, and on September 1 of the past summer one young animal was found with many ticks attached to it, and the examination of the blood demonstrated Texas fever. The other animals in the inclosure were insusceptible Southern animals kept over from previous years, but likewise infested with ticks. Since it is quite impossible that any ticks could have been taken to this inclosure during the past summer, the explanation given above is the only admissible one.

The practical lessons to be drawn from these experiments will be more fully discussed in the special report, as they will be more easily understood when accompanied by illustrations. Meanwhile we would caution against the Southern cattle tick and against all manure from Southern cattle cars in midsummer. When any suspicion exists that the disease has invaded a herd, which is at once detected by a high evening temperature (104° to 107° F.), the herd should immediately be transferred to another pasture. This change, while it may not save all animals, will nevertheless be of some help. The danger that these cattle may infect other healthy stock later on in the season is very slight, excepting when the disease originally appeared very early in summer.

It is to be hoped that during the coming season we may be able to investigate methods of treatment of diseased cattle, and also the means by which ticks may be removed from Southern cattle.

PNEUMONIA IN CATTLE.

During the past two years a number of diseased lungs from cattle have been examined at the laboratory. These came from different localities, many of them sent by inspectors of the Bureau. In summer but few arrived here in any satisfactory condition, and in the most important earlier cases only portions of the entire lungs were received. Several of these cases were subjected to microscopical and bacteriological examination, chiefly for the purpose of making a diagnosis and also of studying forms of pneumonia in cattle which require more than the usual care and skill in bringing out points of difference between ordinary pneumonia and the contagious pleuro-pneumonia. In the Report for 1889 (p. 92), a brief statement was made concerning several cases investigated in that and previous years which might have been mistaken for pleuro-pneumonia, but in which bacteria were encountered which are probably the real cause of the disease.

In the cases studied in 1890 and 1891 there were detected the same bacteria previously encountered. The character and appearance of the lung disease, however, varied considerably in the different cases. These differences will be brought out in detail in another report. The bacteria did not differ materially from swine-plague bacteria, excepting in a few minor details, and we are safe in asserting that there are kinds of pneumonia in cattle caused by bacteria closely resembling those of swine plague and belonging to the same group.

There was no difficulty in distinguishing such disease from pleuro-pneumonia without resorting to microscopic or bacteriological tests. There will, nevertheless, remain some uncertainty about the diagnosis of pleuro-pneumonia so long as the cause has not been determined. Hence the necessity of investigating all forms of pneumonia in cattle which may be confounded with contagious pleuro-pneumonia, so as to reduce errors in diagnosis concerning this plague to a minimum.

EXPERIMENTS WITH THE MILK OF TUBERCULOUS CATTLE.

It has been known for some years that the milk of cows suffering from tuberculosis may contain tubercle bacilli. These bacilli, consumed in the milk by infants and children, may lead to tuberculosis or consumption in one or more of its numerous forms. It has been the object of investigators both in the medical and veterinary professions to find out precisely under what conditions the milk from tuberculous cows may be dangerous. One class maintain that only when the udder becomes the seat of tuberculous changes do the specific bacilli pass into the milk. Another class hold that when a cow is affected with tuberculosis to an advanced degree tubercle bacilli may pass into the milk even when the udder remains free from disease. In the Report for 1889 (p. 105), the question is summed up by giving briefly the results of investigations up to that date. Since then the problem has not been materially changed, and it is obvious that only by collecting a large amount of material can we state positively under what conditions milk should be considered unfit for human food. During the year it was our good fortune to obtain two Jersey cows from a herd in the District of Columbia which were markedly affected with tuberculosis. The milk of these cows was tested for tubercle bacilli, as is shown in the following brief summary:.

The cows (Nos. 155, 156) were received February 28, 1891. March 18 two guinea-pigs were inoculated with the milk of each cow, 5 cubic centimeters (or one-sixth ounce) being injected into the abdominial cavity of each animal. At the same time two young pigs were being fed with the milk daily. April 4 four fresh guinea-pigs were inoculated, two with the milk of each cow.

Cow No. 156 died June 5, with extensive generalized tuberculosis. The udder was carefully examined, but no tuberculous deposits could be detected. The four guinea-pigs were killed after a period ranging from one and one-half to four months after inoculation, but no trace of tuberculosis could be seen in any of them.

Cow No. 155 died June 24. The tuberculous changes were equally advanced, the udder intact. The four guinea-pigs inoculated with milk from this animal were equally free from tuberculosis. On June 22, two days before the death of this cow, two guinea-pigs were inoculated with the milk, which had by this time nearly given out. Both guinea-pigs were killed October 10. In one of these tuberculosis was present, but in a slight degree only, and the animal had grown fat and had failed to show the disease during life. The two pigs which had received the milk daily were killed, but no tuberculous lesions detected.

An examination of the above facts shows that after emaciation had begun in these animals, and from three to four months before they succumbed to advance tuberculosis, no tubercle bacilli were present in the milk. In neither case was the udder found diseased after death. In one case several days before death, when the secretion of milk had almost ceased, a few tubercle bacilli were present. These two cases thus favor the position of those who maintain that tuberculosis of the udder is necessary to an infection of the milk when the disease is not too far advanced. When the animal has become greatly emaciated no self-respecting owner of such animal would use the milk that might still be secreted in small quantities.

Tuberculous deposits in the udder, when they have reached a certain size, can be detected during life. The most marked features of such disease have been described in the Report for 1889 (p. 102). When the tubercles are just beginning to form it may be wholly impossible to detect their presence during life by simple palpation of the bag. For this reason many condemn the milk of all cattle suffering from tuberculosis, because even if the udder is not visibly diseased tubercles may nevertheless be present.

The great importance of a regular periodical inspection of dairy cattle is thus made manifest. If only such animals in which the udder is found diseased would be condemned and the milk rejected a large amount of the injury presumably done by tubercle bacilli in milk could thereby be avoided. Those tuberculous animals in which the disease of the udder escapes attention because of its restricted character would be still liable to distribute tubercle bacilli, but only to a slight degree. Such inspection, if done by competent persons, would largely relieve the apprehensions of the public, which have been aroused by the extended discussion which this dread plague of tuberculosis has undergone in all journals in connection with Koch's lymph.

All that can be done at present is to educate farmers and owners of herds of dairy cows in the vicinity of our large cities, where bovine tuberculosis chiefly exists, concerning the nature of tuberculosis and its manifestations in cattle, and to make them aware of the great danger in the use of milk from cows which are beginning to emaciate or whose udders are diseased.

ABORTION IN MARES.

Early in March of 1890, Dr. Kilborne was directed to make an investigation of an outbreak of abortion among mares in a stud in Pennsylvania. From December to March there had occurred sixteen abortions among fifty-eight pregnant mares. Only one mare aborted during his visit, and from this two agar tubes were inoculated with vaginal secretion by means of platinum loops passed well up into the vagina several hours after the abortion.

In both tubes only one species of bacteria appeared within twenty-four hours. They were carefully studied by the writer and found to resemble closely hog-cholera bacilli in their form, size, and mode of growth on culture media. Their effect on small experimental animals, such as rabbits, could not be distinguished from that of weak or attenuated hog-cholera bacilli. There were a few minor differences which need not be detailed here. Suffice it to say that if this bacillus had been found in a hog-cholera outbreak the writer would have unquestionably considered it a variety of the hog-cholera bacillus. The presence of a pathogenic bacillus in connection with this disease made it necessary to determine whether this bacillus can produce abortion in pregnant mares experimentally. For this purpose cultures in bouillon were prepared and injected into the vagina of one pregnant mare and two pregnant cows by Dr. Kilborne. In all three cases a leucorrhœa or catarrhal discharge appeared one or two days after the injection and lasted several days. None of the animals aborted, however.

Another question needed solution. Is this bacillus commonly met with in the genital passages of pregnant and nonpregnant mares? If so, it probably has no significance. To determine this point agar cultures were inoculated by Dr. Kilborne from the vagina of five mares, one of them pregnant, and these were handed to Dr. V. A. Moore to determine whether the bacillus described was present. It could not be detected.

We can not come to any conclusion as to the relation of this bacillus to the disease in question until more cases have been investigated. On the one hand the disease-producing power of the bacillus and its absence from the vagina under ordinary circumstances are in favor of our regarding it as the cause. On the other hand, the failure to produce the same result artificially upon a pregnant mare is opposed to its specific action. Yet even this experiment is by no means conclusive, since the bacilli may have lost some of their virulence, or the animal experimented on may have been in condition to resist the infection.

It is also desirable to call attention to the possibility of a conveyance of hog-cholera bacilli from diseased swine to pregnant mares. That such a possibility exists may be inferred from the foregoing observations. In fact, with our limited knowledge of animal diseases in general, it is safe to assume that infectious diseases may be transmitted from one species of animals to other species until experience has proved the contrary.

MISCELLANEOUS WORK.

In addition to the foregoing investigations, occasional examinations of disease among domesticated animals occurring in the District of Columbia, which were brought to our notice, were made. Such work included diseases among fowls supposed to be infectious, and the inoculation of guinea-pigs to make the diagnosis in cases of suspected glanders among horses.

In the early part of the year Dr. E. C. Schroeder was directed to make some investigations in Missouri of the so-called cornstalk disease. No satisfactory cases, however, came to his notice, so that no additional information was obtained of the nature of this disease. Dr. Schroeder also made a number of post-mortem examinations of swine which had succumbed to some infectious disease. From these cases both swine-plague and hog-cholera bacteria were isolated, thus indicating the existence of a mixed disease.*

INVESTIGATION OF THE EFFECTS OF BACTERIAL PRODUCTS IN THE PREVENTION OF DISEASES.

By Dr. E. A. de Schweinitz.

A large part of the time during the past year has been occupied in preparing considerable quantities of the active bodies contained in the culture liquids of the hog-cholera and swine-plague germs, and in testing their effect, in conjunction with Dr. Kilborne, upon hogs, with reference to the production of immunity from disease.

A detailed account of the experiments upon guinea-pigs and the methods of making them immune to hog cholera were given in our last report, as well as some preliminary experiments in a similar line with the swine-plague albumose. A few more of the experiments upon guinea-pigs with the swine-plague germ may be added here.

Experiment 1.—Two guinea-pigs of about 1 pound in weight were treated by injecting beneath the skin of the inner side of the thigh a solution of suplagoalbumin in sterilized water. Each pig received 0.0003 gram of the substance. A very slight swelling was noted at the point of injection. The animals, however, appeared quite well again in three or four days. Two checks and the two treated pigs were then inoculated with 0.001 cubic centimeter of peptonized beef broth swine-plague culture one day old. The checks died in thirty-six and forty-eight hours. The autopsies showed characteristic death from swine plague. The two treated pigs appeared ill for two days, but then recovered, so that a very complete immunity had here been produced.

In a second experiment with two treated animals and two checks similar results were obtained, the checks dying in three days and the treated animals being but slightly affected by the virus and finally recovering.

The five sets of experiments so far conducted had shown conclusively that very small quantities of the albumose, obtained from the cultures of the swine-plague germ, are sufficent to make guinea-pigs immune to the test dose of swine plague.

In order to determine if there was any relation between the immunity secured by the treatment for the two different diseases, the following experiments were conducted:

Two guinea-pigs that had been submitted to the preventive treatment for hog cholera were inoculated with 0.001 cubic centimeter of swine-plague culture one day old. Both animals died from swine plague within forty-eight hours.

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*See Special Report on Swine Plague, 1891, p. 82, for details.

In the reverse experiment, four guinea-pigs that had undergone the preventive treatment and recovered from an inoculation with swine plague, together with two checks, were inoculated with 0.1 cubic centimeter of hog-cholera culture one day old. The check animals died in nine and ten days, respectively, the others in ten and eleven days, the autopsies showing characteristic hog-cholera lesions. These results show that in guinea-pigs the two diseases of hog cholera and swine plague are distinct and independent, and that immunity from the one disease leaves the animal still susceptible to the other.

Some parallel experiments on hogs, subsequently conducted at the station by Dr. Smith, showed that acquired immunity from the one disease did not protect the animals from the other.

It was now of interest to determine if guinea-pigs could be successfully treated and exposed to one disease, and after recovery treated and exposed to the second disease. Four sets of experiments were conducted.

In the first two sets, two guinea-pigs were treated with 0.006 gram of swine-plague albumose, and after a week exposed to the disease of swine plague, together with checks. The latter died, while the others recovered. They were then treated with 0.1 gram each of the hog-cholera product, and after some days exposed to the disease of hog cholera, with checks. Here again the checks died and the others recovered.

In the reverse experiment, the guinea-pigs were first treated for hog cholera and exposed, then for swine plague and exposed. In both instances the checks died, while the treated animals recovered.

The group of experiments show conclusively the possibility of successive treatment and secured immunity with guinea-pigs.

Some of the chemical differences between the products of the two diseases may be referred to here. The swine-plague cultures yield on distillation with acid or alone both phenol and indol, the quantity of the latter depending upon the age of the culture. The hog-cholera cultures yield on distillation ammonia and methylamine, the products in solution thereby undergoing a partial decomposition. An analysis of the ash-free swine-plague albumose shows that it contains less nitrogen and carbon than the corresponding hog-cholera product. It is also more easily soluble in water, and is precipitated from this solution by alcohol; like the hog-cholera product, it does not dialyse.

SWINE-PLAGUE EXPERIMENTS UPON HOGS.

The experiments with the swine plague were next extended to hogs, to see if a practical immunity from disease could be secured in these animals by treating them with the extracted active principles of the sterile cultures.

The same manner of treatment as that used upon guinea-pigs was followed.

Four hogs, black Essex and Berkshire, were selected.

No.	Weight.	Age.
	Pounds.	*Months.*
410	40	3
411	40	3
412	45	3
413	40	3

Nos. 410 and 411 were treated, the other two reserved for checks.

On November 26, 1890, Nos. 410 and 411 were given a subcutaneous injection of 3½ cubic centimeters (0.2 gram) each of the solution of suplagoalbumin. There were no resulting ill effects from this injection, either in the general health of the animal or the production of a local lesion. On December 4, 1890, these two animals, and also the two checks, were inoculated in the femoral vein with 1¼ cubic centimeters of peptonized beef infusion swine-plague culture one day old. Both of the checks, 412 and 413, died on December 5, fifteen hours after the inoculation. Autopsies showed death from swine plague. Of the treated animals, No. 410 was but slightly affected by the inoculation with the germ, and on December 9 appeared entirely recovered. No. 411, on the contrary, was very sick from the inoculation, had been down, unable to rise since December 7, and finally died on December 22, two weeks after the checks. The autopsy made by Dr. Smith was as follows:

> The animal was greatly emaciated; weight only 28 pounds. There was an enlargement of both knee and hock joints, but the disease appeared to be confined to the joints only. Lungs show no inflammation or hepatization. Right heart filled with large dark clot; left with larger partially washed clot. Gall bladder distended with very thick bile, holding large quantities of solids in suspension. Liver more firm than normal. Stomach contracted; contains a very small quantity of viscid bile-stained liquid. Spleen not enlarged; pulp rather dark. Kidneys rather small; on section show fatty degeneration. Two rabbits, inoculated with pus from the knee-joint dead in twenty-four hours; autopsy showed death from swine plague; cover-glass preparations from the spleen and liver showed swine-plague germs.

In the second experiment the exposure with the germ was not severe enough to kill the checks, hence no conclusions could be drawn. The third experiment was as follows:

Five hogs, black grade, were taken.

No.	Age.	Weight.
	Months.	*Pounds.*
466	3	55
467	3	50
456	3	50
457	3	40
458	3	45

Nos. 456, 457, and 458 served as checks. Nos. 466 and 467 were treated by a subcutaneous injection of 0.3 gram albumose for each animal on February 28, 1891. On April 3, 1891, all the pigs were inoculated intravenously with 2 cubic centimeters of peptonized beef broth swine-plague culture (No. 15) one day old.

Check No. 457 died April 4; check No. 458 died April 10; check No. 456 died April 5.

Treated pig No. 466 died April 4; No. 467 was made ill for two to three days by the inoculation, but by April 10 was entirely well. The autopsies upon the animals were made by Dr. Kilborne, and showed death from swine plague. The exposure with the virus in this case was a little too severe.

For the fourth experiment, pigs Nos. 492, 496, 499, and 500 were treated on May 12 by a subcutaneous injection of a water solution of 1 gram swine-plague albumose each. On May 4 pigs Nos. 493, 494, 497, and 498 were treated in the same way, with 0.7 gram of albumose each, and again on May 12 with 1 gram more of albumose each. May 21 these eight animals and four checks were inoculated intravenously with 2¼ cubic centimeters of swine-plague culture. One check died May 22, the second check on May 25, and the third on July 6. The fourth check was quite sick from the inoculation for some time, but finally recovered.

One of the treated animals, No. 500 (one of the lot that had the smaller amount of albumose), was made ill by the inoculation, but recovered. Another one was killed by fighting, but autopsy showed no signs of death from swine plague. The other treated animals were but little affected by the inoculation and recovered quickly. The result was, therefore, that none of the treated animals died from the exposure. Three of the checks died and the fourth was very ill. Still another experiment was tried with five animals and five checks. The exposure with the virus, however, was not sufficiently severe to kill any of the checks, although the latter suffered a great deal more from the inoculation with the virus than the treated animals. The germ used for the inoculation had evidently become attenuated.

We can safely conclude from these experiments that hogs can be made immune by treatment with a fairly small dose of the albumose obtained from the cultures of the swine-plague germ. This immunity is sufficient to protect the animal from an intravenous injection of virus which would kill the checks or nontreated animals in from forty-eight to seventy-two hours.

HOG CHOLERA.

The experiments upon hogs with the view of making them immune to the disease of hog cholera have also been continued. Some have been fruitless, owing to a too severe or too slight dose of virus for the exposure. Others have been only partially successful. One of these experiments may be recorded here:

No.	Weight.	Age.	No.	Weight.	Age.
	Pounds.	*Months.*		*Pounds.*	*Months.*
16	40	3½	24	50	3½
17	45	3½	25	40	2
18	40	3½	26	40	3
19	40	3½	27	40	3
20	55	3½	28	35	3
21	60	3½	29	35	3
22	55	3½	30	40	3
23	50	3½			

Nos. 16, 19, 23, 24, 25, and 28 were treated with the substance isolated from the cultures. Nos. 17, 20, 22, 29, and 30 were used as checks, and Nos. 18, 21, 26, and 27 were treated by two intravenous injections of a small quantity of the hog-cholera culture to serve as a check upon the severity of the final exposure.

On June 22 all of the pigs were inoculated in the vein with 5 cubic centimeters each of a peptonized beef broth hog-cholera culture two days old.

Of the checks, Nos. 30 and 29 died six days after the inoculation, and No. 22 twenty days after the inoculation.

No. 27, one of the pigs which had been treated by an intravenous inoculation with small quantities of the germ, died nineteen days after the final exposure.

One of the treated animals, No. 28, died thirteen days after the exposure; the others were ill, but recovered nicely and are in good condition.

While not perfectly successful, it is fair to conclude that the treated animals were protected to some extent. Of the five checks three died. Of the four treated by intravenous injections one died, and of the six animals treated with the active extract from the cultures only one died.

We have hopes that this method can be further improved so as to make the pigs immune to the disease of hog cholera.

GLANDERS.

In December, 1890, a preliminary experiment with glanders cultures was made with the view of extracting from them an albumose, if such existed. Dr. Smith had prepared for me some acid glycerin peptonized beef broth media. After inoculation these flasks were allowed to stand at the temperature of the room, 26° C., for about two months. They were then heated for several hours at 80° C., and the filtered culture subjected to treatment with alcohol. In this way an albumose was obtained soluble in water, nondialysable, precipitated from its water solution by alcohol.

The effect of this albumose in producing immunity in guinea-pigs was tested. First one guinea-pig was treated by a subcutaneous injection of a solution of 0.01 gram of the albumose, and a few days afterwards two more guinea-pigs received 0.05 gram of albumose each. These injections caused inflammation and swelling, which disappeared in ten days to two weeks. Forty days after this injection these animals and two checks were all inoculated by Dr. Kilborne at the station with a loop of a glycerin peptonized beef broth glanders culture. One of the checks died from glanders thirteen days after the inoculation. The one of the treated pigs that had the small dose of albumose died thirteen days and one of the other treated animals ten days after the inoculation. The second check did not die until three months after the inoculation. The third treated animal recovered. A second experiment in this line on a larger scale is at present being carried on. The effect of this substance as a means of diagnosis is also being tested.

TRANSACTIONS OF THE BUREAU FOR 1892.

Since April 1, 1891, the force of the Bureau of Animal Industry has been divided, by order of the Secretary of Agriculture, into four divisions, viz, the Inspection Division; the Division of Animal Pathology; the Division of Field Investigations and Miscellaneous Work, and the Division of Quarantine. The different branches of the work will therefore be considered as it was in the report of last year, under the head of the division to which each belongs.

INSPECTION DIVISION.

To this division is assigned all work of an executive nature, including the eradication of contagious diseases, the inspection of export and import animals, meat inspection, vessel inspection, and the regulation of the movement of animals infected with the protozoal disease known as splenctic, or Texas fever of cattle.

CONTAGIOUS PLEURO-PNEUMONIA.

One of the chief objects for the establishment of the Bureau of Animal Industry, as specified in the organic act creating the Bureau, was the eradication of the disease of cattle known as contagious pleuro-pneumonia. This work has been carried on as rapidly as was possible under the conditions prevailing in this country. In the report of the operations for the year 1891 it was stated that all of the States which had been infected with this disease had been freed from the contagion, with the single exception of the State of New Jersey. In that State four affected herds had been found during the year, and it was not possible to consider the State free from infection. The number of inspectors was increased and a vigorous policy of inspection and quarantine was continued, the result being the discovery of the disease in a few additional herds. The affected animals and all which had been in contact with them were at once slaughtered, and the result was the complete disappearance of the disease. No affected animals have been found in New Jersey or in any other State since March 25, 1892. On the 26th day of September, 1892, the following proclamation was issued, declaring the United States to be free from this disease.

PROCLAMATION—ERADICATION OF PLEURO-PNEUMONIA.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.

To all whom it may concern:

Notice is hereby given that the quarantines heretofore existing in the counties of Kings and Queens, State of New York, and the counties of Essex and Hudson, State of New Jersey, for the suppression of contagious pleuro-pneumonia among cattle, are this day removed.

The removal of the aforesaid quarantines completes the dissolving of all quarantines established by this Department in the several sections of the United States for the suppression of the above-named disease.

No case of this disease has occurred in the State of Illinois since December 29, 1887, a period of more than four years and eight months.

No case has occurred in the State of Pennsylvania since September 29, 1888, a period of four years within a few days.

No case has occurred in the State of Maryland since September 18, 1889, a period of three years.

No case has occurred in the State of New York since April 30, 1891, a period of more than one year and four months.

No case has occurred in the State of New Jersey since March 25, 1892, a period of six months, and no case has occurred in any other portion of the United States within the past five years.

I do therefore hereby officially declare that the United States is free from the disease known as contagious pleuro-pneumonia.

J. M. RUSK,
Secretary.

Done at the city of Washington, D. C., this 26th day of September, A. D. 1892.

Since this proclamation was issued, a continuous inspection has been maintained in New Jersey, and in that portion of New York adjoining the district of New Jersey which had been infected, but no animal has since been found showing any evidence of being affected with pleuro-pneumonia. The success of this branch of the work of the Bureau of Animal Industry has therefore been complete, and this dangerous and much dreaded disease has been eradicated from our soil.

The United States is the first of the large nations of the world which, having been once extensively infected with this contagion, has been able to completely extirpate it. The time required for this was only about five years, and the total expenditure has been but a little in excess of $1,500,000. When it is considered that there were grave doubts entertained of the possibility of eradicating this disease, and also that other countries have labored a much longer time and made greater expenditures of money without success, the favorable outcome from our efforts which has been reached in such a comparatively short time, and with so small an expenditure of money, is one with which we have every reason to be pleased. The danger from this source which menaced the American cattle industry has been removed, the local restrictions placed upon our interstate trade have been revoked, and the cattle market is beginning to recover from these depressing influences. The following tables show the amount of work which has been done in the different infected States, by years, and also a summary of the whole work:

Table showing the amount of work done in the State of Illinois, by years, for the eradication of pleuro-pneumonia.

	Sept. 1, 1886, to Dec. 3, 1887.	1888.	Total.
Herds inspected	7,411	140	7,551
Cattle inspected	24,059	285	24,344
Post-mortem examinations	7,207	1,712	8,979
Number diseased on post-mortem	350	4	354
Premises disinfected	677	1	678
Diseased cattle purchased	172	4	176
Exposed cattle purchased	870	129	999

Table showing amount of work done in the State of Maryland, by years, for the eradication of pleuro-pneumonia.

	1887.	1888.	1889.	1890.	Total.
Herds inspected	5,704	9,809	10,904	4,210	30,627
Cattle inspected	57,868	60,312	79,606	108,376	306,152
Cattle tagged		17,749	10,534	5,463	33,746
Post-mortem examinations	2,788	5,820	11,491	12,949	33,048
Number diseased on post-mortem	1,137	507	76		1,720
Premises disinfected	145	145	35	1	326
Diseased cattle purchased	1,442	459	73		1,974
Exposed cattle purchased	1,564	1,036	310	20	2,930

NOTE.—To the items "Diseased cattle purchased" and "Exposed cattle purchased," in 1887, are added all purchases of cattle from July 1, 1883, to December 31, 1886.

Table showing amount of work done in the State of New York, by years, for the eradication of pleuro-pneumonia.

	1887.	1888.	1889.	1890.	1891.	1892.	Total.
Herds inspected	1,511	12,333	15,861	19,569	13,381	2,537	65,192
Cattle inspected	25,122	99,726	149,396	150,474	136,111	49,925	610,754
Cattle tagged		100,370	33,135	33,752	30,294	13,558	211,109
Post-mortem examinations	1,347	15,538	15,375	18,338	26,953	18,871	96,422
Number diseased on post-mortem	447	2,287	1,012	544	31		4,321
Premises disinfected		1,339	339	434	49		2,161
Diseased cattle purchased	206	1,576	1,053	427	25		3,347
Exposed cattle purchased	736	3,196	2,819	1,984	284		9,019

NOTE.—The figures for 1892 are brought down to September 26, the date on which the quarantine was removed.

Table showing amount of work done in the State of New Jersey, by years, for the eradication of pleuro-pneumonia.

	1887.	1888.	1889.	1890.	1891.	1892.	Total.
Herds inspected	1,428	8,018	8,455	8,492	8,124	16,813	51,330
Cattle inspected	16,461	72,095	76,001	60,659	68,262	128,017	421,495
Cattle tagged		13,318	11,672	8,817	12,818	22,153	68,778
Post-mortem examinations	248	6,846	14,242	9,419	4,417	5,562	40,734
Number diseased on post-mortem	113	514	189	43	63	32	954
Premises disinfected		275	208	104	57	196	840
Diseased cattle purchased	94	502	116	44	48	40	844
Exposed cattle purchased	117	945	714	242	227	222	2,467

NOTE.—The figures for 1892 are brought down to September 26, the date on which quarantine was removed.

Table showing amount of work done in the State of Pennsylvania, by years, for the eradication of pleuro-pneumonia.

	1888.	1889.	1890.	1891.	1892.	Total.
Herds inspected	5,291	1,311	1,915	1,096	2,638	12,251
Cattle inspected	72,565	24,003	24,388	55,533	66,487	242,976
Cattle tagged	51,820	1,513				53,333
Post-mortem examinations	13,157	13,412	15,008	55,260	80,384	177,221
Number diseased on post-mortem	72	17				89
Premises disinfected	117	6				123
Diseased cattle purchased	63					63
Exposed cattle purchased	131	11				142

NOTE.—The figures for 1892 are brought down to September 26, the date on which the quarantine was removed.

Table summarizing amount of work done in the different States in which pleuro-pneumonia has existed, for the eradication of this disease.

	Illinois.	Maryland.	New York.	New Jersey.	Pennsylvania.	Grand total.
Total herds inspected	7,551	30,627	65,192	51,330	12,251	166,951
Total cattle inspected	24,344	306,152	610,754	421,495	242,976	1,605,721
Total cattle tagged		33,746	211,109	68,778	53,333	366,966
Total post-mortem examinations	8,979	33,048	96,422	40,734	177,221	356,404
Total diseased on post-mortem	354	1,720	4,321	954	89	7,438
Total premises disinfected	678	326	2,161	840	123	4,128
Total diseased cattle purchased	176	1,974	3,347	844	63	6,404
Total exposed cattle purchased	999	2,930	9,019	2,467	142	15,557

NOTE.—To the items "Total diseased cattle purchased" and "Total exposed cattle purchased" are to be added the following: Purchased in Virginia and District of Columbia, 45 diseased animals, making a total of 6,449; Virginia and District of Columbia, 57 exposed animals, making a total of 15,614.

The following table gives a summary of the expenditures for the eradication of pleuro-pneumonia from the beginning of the work to September 1, 1892:

Table showing expenditures for the eradication of contagious pleuro-pneumonia from July 1, 1886, to September 1, 1892.

State.	Salaries.	Traveling.	Miscellaneous.	Affected cattle.	Exposed cattle.	Total.	No. of animals.	
							Affected.	Exposed.
New York	$385,672.70	$58,013.29	$28,897.52	$87,241.69	$198,669.80	$758,495.00	3,347	9,019
New Jersey	185,533.92	44,018.03	12,956.79	20,477.50	60,967.70	323,953.94	844	2,467
Pennsylvania	40,201.36	4,462.42	2,614.66	1,243.50	3,357.50	51,879.44	63	142
Maryland	124,948.22	33,705.74	5,667.42	48,363.41	76,115.85	288,800.64	1,974	2,930
Illinois	52,170.31	3,819.29	4.126.61	3,260.80	16,561.64	79,938.65	176	999
Vermont,* Mass.,* Virginia, and District of Columbia	3,342.28	1,177.72	19.55	739.00	754.50	6,033.05	45	57
Total	791,868.79	145,196.49	54,282.55	161,325.90	356,426.99	1,509,100.72	6,499	15,514

* Investigating reported outbreaks.

MOVEMENT OF CATTLE FROM SPLENETIC FEVER DISTRICT.

The regulations for preventing the dissemination of the disease known as splenetic or Texas fever, which have been enforced during 1892, are substantially the same as those issued in 1891. The changes which have been made have had the effect to place outside of the infected district a number of counties in Texas, Tennessee, North Carolina, and Virginia which were previously included in this district, but which experience has shown were free from the contagion. The object of the regulations is to separate the infected from the noninfected cattle in the stock yards and channels of transportation outside of the infected district, and to secure the cleaning and disinfection of all cars which have carried infected cattle. The regulations have not prevented or hindered the shipment of cattle from the infected districts to the markets for slaughter, nor have they depreciated the value of these cattle. On the contrary, they have had a marked tendency to sustain and increase the values of cattle by preventing losses from this disease, and by increasing the purchases for feeding purposes, on account of the safety with which these can now be made. The full text of the regulations is as follows:

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 26, 1892.

To the managers and agents of railroad and transportation companies of the United States, stockmen, and others:

The regulations concerning cattle transportation issued by this Department January 11, 1892, are hereby revoked, and the following prescribed in place thereof:

In accordance with section 7 of the act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases of domestic animals," and of the act of Congress, approved March 4, 1891, making appropriation for the Department of Agriculture for the fiscal year ending June 30, 1892, you are hereby notified that a contagious and infectious disease known as splenetic or Southern fever exists among cattle in the following-described area of the United States:

All that country lying east and south of a line commencing at the southwest corner of Valverde County, State of Texas, on the Rio Grande River; thence running northerly along the western boundaries of Valverde and Crockett counties to the northwest corner of Crockett County; thence easterly along the northern boundaries of Crockett and Schleicher counties to the southeastern corner of Irion County; thence northerly along the eastern boundary of Irion County to the northeast corner of said county; thence northerly to the southern boundary of Coke County; thence westerly to the southwestern corner of Coke County; thence northerly along the western boundary of Coke County to the southern boundary of Mitchell County; thence easterly to the southeast corner of Mitchell County; thence northerly along the western boundaries of Nolan and Fisher counties to the southern boundary of Kent County; thence easterly along the southern boundary of Kent County to the southwestern corner of Stonewall County; thence northerly along the western boundary of Stonewall County to the southeastern corner of Dickens County; thence easterly along the northern boundary of Stonewall County to the southwestern corner of Knox County; thence northerly along the western boundaries of Knox and Hardeman counties to the Red River; thence northwesterly following the Red River to its point of intersection with the one hundredth meridian of longitude; thence northerly from said point of intersection along said one hundredth meridian to the southern boundary of the State of Kansas; thence easterly along the southern boundary of the State of Kansas to the northeast boundary of the Indian Territory; thence southerly along the eastern boundary of the Indian Territory to the southwest corner of the State of Missouri; thence easterly along the southern boundary of the State of Missouri to the Mississippi River; thence running southerly along the Mississippi River to the southwestern corner of the county of Lauderdale, State of Tennessee; thence running easterly, following the southern boundaries of the counties of Lauderdale, Crockett, Gibson, Carroll, Benton, Perry, Lewis, Maury, Marshall, Bedford, Coffee, Grundy, Sequatchie, Hamilton, Meigs, McMinn, and Monroe, State of Tennessee, to the easterly boundaries of said State; thence following the northern boundaries of the counties of Cherokee, Macon, Jackson, Transylvania, and Henderson, State of North Carolina, to the southeast corner of the county of Buncombe of said State; thence in a northeasterly direction, following the Blue Ridge Mountains, to the southwestern corner of the county of Madison, State of Virginia; thence easterly along the southern boundaries of the counties of Madison, Culpeper, and Stafford; thence northerly along the eastern boundary of Stafford County to the Potomac River; thence following the Potomac River southerly to the Chesapeake Bay; thence easterly along the southern boundary of the State of Maryland to the Atlantic Ocean.

From the 1st day of March to the 1st day of December, 1892, no cattle are to be transported from said area to any portion of the United States north or west of the above-described line, except by rail for immediate slaughter, and when so transported the following regulations must be observed:

(1) When any cattle in course of transportation from said area are unloaded north or west of this line to be fed or watered, the places where said cattle are to be fed or watered shall be set apart and no other cattle shall be admitted thereto.

(2) On unloading said cattle at their points of destination, pens shall be set apart to receive them, and no other cattle shall be admitted to said pens; and the regulations relating to the movement of Texas cattle, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars that have carried said stock shall be cleansed and disinfected before they are again used to transport, store, or shelter animals or merchandise.

(3) All cars carrying cattle from said area shall bear placards stating that said cars contain Southern cattle, and each of the waybills of said shipments shall have a note upon its face with a similar statement. Whenever any cattle have come from said area and shall be reshipped from any point at which they have been unloaded to other points of destination, the cars carrying said animals shall bear similar placards, with like statements, and the waybills be so stamped. At whatever point these cattle are unloaded they shall be placed in separate pens, to which no other cattle shall be admitted.

(4) The cars used to transport such animals, and the pens in which they are fed and watered, and the pens set apart for their reception at points of destination, shall be disinfected in the following manner:

(*a*) Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime or diluted sulphuric acid, or, if not disinfected, it may be stored where no cattle can come into contact with it until after December 1.

(*b*) Wash the cars and the feeding and watering troughs with water until clean.

(*c*) Saturate the walls and floors of the cars and fencing, troughs, and shutes of the pens, with a solution made by dissolving four ounces of chloride of lime to each gallon of water. Or disinfect the cars with a jet of steam under a pressure of not less than fifty pounds to the square inch.

(5) It is expressly provided that cattle may be removed from those counties in the State of Tennessee which lie south of the. line hereinabove described to those counties lying north of said line in said State for grazing purposes, in accordance with the regulations of the authorities of the State of Tennessee.

(6) It is further expressly provided that cattle which have been at least ninety days in the counties of Coke, the eastern portion of Tom Green, Nolan, Fisher, Stonewall, Haskell, Knox, and Hardeman, State of Texas, which lie within the above-described area, may be moved from said counties by rail into the States of Colorado, Wyoming, and Montana, in accordance with the regulations made by said States for the admission of Southern cattle thereto: *Provided*,

(1) That cattle from said area shall go into said States only for slaughter or grazing, and shall on no account be shipped from said States into any other State or Territory of the United States before the 1st day of December, 1892.

(2) That such cattle shall not be allowed in pens or on trails or on ranges that are to be occupied or crossed by cattle going to the eastern markets before December 1, 1892, and that these two classes of cattle shall not be allowed to come into contact.

(3) That all cars which have carried cattle from said area shall, upon unloading, at once be cleaned and disinfected in the manner provided by these regulations.

(4) That the State authorities of the States of Colorado, Wyoming, and Montana agree to enforce these provisions.

The losses resulting yearly to the owners of susceptible cattle in the interstate and export trade, by the contraction of this disease from exposure in unclean and infected cars and pens, and by means of the manure carried in unclean cars from place to place, have become a matter of grave and serious concern to the cattle industry of the United States. It is absolutely essential, therefore, that this cattle industry should be protected as far as possible by separating the dangerous cattle and by the adoption of efficient methods of disinfection.

Inspectors will be instructed to see that disinfection is properly done, and it is expected that transportation companies will promptly put into operation the above methods.

Very respectfully,

J. M. RUSK,
Secretary.

The following supplementary regulations were made during the year:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 13, 1892.

Notice is hereby given that the regulations of the U. S. Department of Agriculture, dated February 26, 1892, concerning cattle transportation, are modified so as to exclude the counties of Orange, Albemarle, Greene, Nelson, and Amherst, in the State of Virginia, from the infected area described in said regulations, and the quarantine line established by said regulations is hereby changed so as to run along the southern boundaries of said counties, placing these counties north of said line.

J. M. RUSK,
Secretary.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 5, 1892.

The permission granted to ship cattle from the counties named in the sixth regulation of the Regulations of the Department of Agriculture, of date February 26, 1892, concerning cattle transportation into the States of Colorado, Wyoming, and Montana, is hereby extended to shipments, under the conditions named in said sixth regulation, to the State of South Dakota.

J. M. RUSK,
Secretary.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 18, 1892.

To the managers and agents of railroad and transportation companies of the United States, stockmen, and others:

Whereas the county of Uvalde, State of Texas, was, by an order duly made by the Secretary of Agriculture, on the 26th day of February, 1892, in pursuance of the act of Congress of May 29, 1884, and acts supplemental thereto, declared to be infected with a contagious and infectious disease, known as splenetic or Southern fever; and

Whereas the county of Pecos, State of Texas, was, by said order, included in the area of country declared to be free of the said contagious and infectious disease; and

Whereas a large number of cattle have been moved from the said county of Uvalde into the county of Pecos, State of Texas, since the making of said order, and such movement of cattle is a violation of said order, and the cattle moved into Pecos County having rendered all cattle in said county dangerous to be moved into other uninfected areas of the United States: It is therefore

Ordered, That no cattle shall be moved from the county of Pecos, State of Texas, into parts of the United States north or west of the said county of Pecos, except for purposes of immediate slaughter, and then to be kept separate as infected cattle.

J. M. RUSK,
Secretary.

These regulations concerning cattle transportation have been as rigidly maintained as was possible under existing laws. In the main they have been extremely successful in preventing the spread of the disease, and cattle have been safely purchased in all the large stock yards of the country for feeding purposes without any losses having occurred among them from splenetic fever. The numerous large outbreaks which have been the rule in former seasons have not occurred, and with the exception of an outbreak in western Texas, and one in Lyons and adjoining counties in Kansas, none have been reported. The number of cases of splenetic fever occurring among export cattle has also been greatly reduced, as compared with former years. One of the main causes of the appearance of splenetic fever among export cattle is the shipment of these animals in cars which had not been disinfected, and which had carried infected cattle to points in various States where this Department had no representatives. The Department has maintained a corps of inspectors at all of the large stock yards to which infected cattle are transported, and from which they are sent to other points in small consignments, and has, whenever possible, informed the authorities of the various States to which cars containing such cattle were going of their destination. In such cases it has been necessary to leave to State authorities the enforcement of their local regulations for handling such cattle and for disinfecting the cars. In many cases, however, the cars under such circumstances are not disinfected, and being used for the shipment of susceptible cattle, the disease is thereby contracted. The prevention of this disease will probably not be absolute until Congress enacts some legislation that will compel railroad companies to comply with the regulations for cleaning and disinfecting cars that have carried infected cattle, and to provide penalties for the violation of the other sections of the regulations. There have been reported 131 head of cattle in the export trade affected with this disease during 1892, as compared with 524 for the same period in 1891. This shows a very gratifying improvement, but in order to maintain the reputation of our export cattle, and to keep the trade at its present proportions, the exposure of export cattle to the disease must be entirely prevented. This can only be accomplished by rigidly maintaining the boundary lines of the infected district as at present defined, and in adopting still more stringent measures to secure the disinfection of cars. The following table shows the places at which inspection has been made, the number of cattle which have been inspected, and also the number of cars which have been cleaned and disinfected under the supervision of Department employees:

Statement showing work performed by inspectors of the Bureau of Animal Industry in supervising the movement of infected cattle during the quarantine season, February 26, to December 1, 1892.

Place.	Car loads of cattle received from infected district and inspected at quarantine pens.	Cattle contained in cars received at quarantine pens.	Car loads in transit for points beyond.	Cars cleaned and disinfected.
South Omaha, Nebr.	274	6,939	17	274
Chicago, Ill	25,628	690,681	2,476	25,173
Kansas City, Mo	12,344	356,970	7,498	....
East St. Louis, Ill	15,415	430,126	10,754	....
Indianapolis, Ind	1,361	28,581	1,134	265
Pittsburg, Pa	580	15,269	539	41
Baltimore, Md	8	172	3	7
Philadelphia, Pa	504	10,594	37	504
New York, N. Y	1,218	39,862	....	1,218
Boston, Mass	50	977	....	....
Buffalo, N. Y	1,286	39,151	1,213	873
Argentine, Kans	7,597	229,809	7,597	6,644
Herington, Kans	3,942	109,391	3,942	2,098
Parsons, Kans	9,086	243,051	9,086	2,016
State Line, Kans	2,058	57,110	2,058	1,323
Baxter Springs, Kans	306	8,976	306	79
Poplar Bluff, Mo	1,920	53,280	1,920	....
Springfield, Mo	8,177	227,662	8,177	....
Total	91,754	2,545,601	56,757	40,515

It appears from the above table that more than two and a half millions of cattle from the infected district have been inspected and kept separated from other cattle in the channels of commerce, and that more than forty thousand cars have been disinfected under the supervision of the Department inspectors. This great amount of work has been accomplished without friction, and without hardship to those who have owned the stock. It is a line of work which has been extremely popular, as every one who has been engaged in the shipment or sale of cattle has been able to see the benefits which the regulations have secured. Just how much has been saved by the prevention of disease and facilitating the movement and sale of cattle it is impossible to accurately estimate, but there is no doubt that it amounts to several millions of dollars. The insurance on export cattle has been greatly reduced because of the diminution of losses from this disease, and it is estimated that there has been a saving in this direction alone of about $5 on each animal exported. This would amount to nearly $2,000,000 with the number of cattle exported during the present year.

INSPECTION OF EXPORT ANIMALS.

The inspection of animals for export has been continued during the year, under the provisions of the act of Congress approved August 30, 1890, and in the manner described in the last report made to Congress. The animals inspected have been principally cattle, and the following table shows the number inspected, the points at which the inspection was made, the number tagged for export, and the number of animals rejected by the inspectors:

Statement showing number of cattle inspected and tagged for export at the various stock yards and ports during the fiscal year ending June 30, 1892; also number rejected on account of disease.

Stock yards.	Inspected.	Tagged.	Rejected.
Chicago, Ill	244,109	247,343	766
Buffalo, N. Y	153,435	33,006	46
Baltimore, Md	70,530	41,116	5
Philadelphia, Pa	28,509	2,293	4
Indianapolis, Ind	2,677	....	....
Pittsburg, Pa	27,568	8,248	6
Boston, Mass	129,512	20,417	7
Portland, Me	8,251	45	....
New York, N. Y	149,800	86,460	9
Norfolk, Va	912	912	....
New Orleans, La	661	661	....
Newport News, Va	8,242	2,889	....
Total	824,206	389,480	843

Under the column "Inspected" is included all reinspections made at ports of export of cattle previously inspected and tagged at interior yards; also reinspections made at the yards at Buffalo and Pittsburg of cattle that had previously been inspected at Chicago. This column shows the total amount of work done at the various yards and ports throughout the country in the handling of export cattle.

The following table shows the number of vessels inspected, the number of cattle exported from the various ports, and the countries to which they were shipped:

Exports of domestic cattle to Europe for the fiscal year ending June 30, 1892, as compared with the exports for the fiscal year ending June 30, 1891.

Port of export.	Steamers inspected.	Great Britain.	Germany.	Belgium.	France.	Total.
New York, N. Y	382	145,762	3,440	448	150	149,800
Boston, Mass	240	129,512	....	....	....	129,512
Baltimore, Md	153	62,422	382	588	520	63,912
Philadelphia, Pa	78	28,190	....	....	....	28,190
New Orleans, La	5	661	....	....	....	661
Portland, Me	24	8,251	....	....	....	8,251
Norfolk, Va	5	912	....	....	....	912
Newport News, Va	30	8,242	....	....	....	8,242
Aggregate fiscal year ending June 30, 1892	917	383,952	3,822	1,036	670	389,480
Aggregate fiscal year ending June 30, 1891	489	344,417	5,518	6,582	5,885	362,402

NOTE.—The exports for the fiscal year ending June 30, 1892, show an increase of 7½ per cent over the exports for the preceding year.

INSPECTION OF IMPORT ANIMALS.

The inspection of animals imported into the United States under the provisions of the act of Congress approved August 30, 1890, is made partly under the Inspection, and partly under the Quarantine Division of this Bureau. Animals from Canada and Mexico are inspected at ports of entry, and in case they are found healthy are allowed entry without detention. This inspection is made by the Inspection Division. Animals coming from other countries than those situated in North, Central, and South America, are quarantined at the port of entry under the direction of the Quarantine Division. This work will be referred to later on in this report. No entries of animals have been reported from Mexico during the year. The number and kind of animals imported from Canada, as reported by the inspectors of the Inspection Division, is shown by the following table:

Statement showing the imports of cattle, sheep, and swine into the United States from Canada during the fiscal year ending June 30, 1892.

Port of entry.	Cattle.	Sheep.	Swine.	Remarks.
Buffalo, N. Y	185	194,103	1	
Charlotte, N. Y	....	2,858	....	
Suspension Bridge, N. Y	5	504	....	
Richford, Vt	2	8,932	....	
Newport, Vt	783	18,323	....	513 cattle en route to Boston for export.
Vanceboro, Me	3	29,176	....	
Houlton, Me	5	11,156	2	
Ogdensburg, N. Y	4	34,879	....	
Morristown, N. Y	6	6,565	6	
Cape Vincent, N. Y	19	3,579	2	
Rouses Point, N. Y	2	13,766	8	
St. Albans, Vt	1,389	10,169	....	1,388 cattle en route to Boston for export.
Island Pond, Vt	103	34,356	2	100 cattle en route to Boston for export; 103 sheep quarantined for foot-rot; recovered.
Detroit, Mich	120	1,450	12	
Port Huron, Mich	47	3,701	41	
Total	2,973	373,517	74	

NOTE.—This statement does not include imported live stock received at the quarantine stations located on the seaboard.

The necessity for the inspection of animals from Canada is evident from the widespread prevalence of foot-and-mouth disease and pleuro-pneumonia in Europe, and the constant importation of animals from Europe into Canada. Only one lot of animals from Canada has been detained, and that was a lot of 123 sheep affected with foot-rot, a contagious disease which causes heavy losses to sheep-owners, and which should be guarded against. At present there is no authority for inspecting imported horses, and as these animals are liable to be affected by any one of several serious contagious diseases, some provision should be made for the inspection of these animals, and for preventing their entry in case they are found to be affected with such diseases.

REVOCATION OF ORDER REQUIRING SLAUGHTER OF SHEEP LANDED IN GREAT BRITAIN.

It should be mentioned, in this connection, that since the regulations of the Secretary of Agriculture have been enforced which require the quarantine of sheep imported into the United States, and, also, the inspection of exported sheep, an order has been issued by the British authorities revoking the regulations which caused the slaughter of sheep from this country on the docks where landed. This concession is extremely gratifying, since this burdensome restriction on the export trade in live sheep had been in operation for thirteen years. The order removing this restriction went into effect September 1, 1892.

INSPECTION OF AMERICAN CATTLE IN GREAT BRITAIN.

The American veterinarians located at the foreign animals wharves in Great Britain, by the courtesy of the British authorities, have continned inspecting cattle landed there from this country. The object of this inspection has been to learn the condition in which our cattle arrive, the extent of the losses at sea, and to determine if the lung disease with which some of these animals have been found affected by the British inspectors was really contagious pleuro-pneumonia, as alleged by them. In order to obtain all the evidence possible on this point, our cattle have all been tagged with a number, and records kept by which they could be traced to the stock yard where originally purchased, and also to the farms on which they were fed. This gives a history of any individual animal in connection with the veterinarian's diagnosis of disease. During the fiscal year ending June 30, 1892, four animals have been reported by the British inspectors as being affected with contagious pleuro-pneumonia. Two of these, according to the opinion of the American inspectors, were affected with broncho-pneumonia, from cold and exposure during the voyage, and two were reported as affected with emphysema of the lungs. In none was there any appearance of contagious pleuro-pneumonia. The tag numbers of these animals were cabled to the Department, an inspector was sent to the farms from which they came, where a careful investigation showed that there had been no contagious disease of cattle to which these animals might have been exposed. It is evident, therefore, that none of these animals were affected with contagious pleuro-pneumonia, because this disease did not exist in the section of the country from which they came. The total number of cattle inspected by the veterinarians of this Department in Great Britain during the year, and the loss reported by them as having occurred at sea, is shown by the following table:

Statement showing losses at sea and number of cattle inspected by United States inspectors stationed at London, Liverpool, and Glasgow, during the fiscal year ending June 30, 1892.

Port.	No. cattle inspected.	Loss at sea.
London	139,750	991
Liverpool	183,693	1,814
Glasgow	44,571	468
Total	368,014	3,273

Percentage of loss during the fiscal year ending June 30, 1892, seven-eighths of 1 per cent.
Percentage of loss during the fiscal year ending June 30, 1891, 1⅜ per cent.

It will be interesting at this time to review the alleged cases of contagious pleuro-pneumonia found among United States cattle by the British inspectors since the representatives of this Department have been stationed in England. The official reports state that fourteen cases of pleuro-pneumonia were found in 1890 among cattle from the United States. The American inspection began August 16, 1890, and from that time to the end of the year no cases alleged to be this disease were reported. The entire number reported had consequently been found previous to August 16, and the sudden disappearance of the disease indicated either that the eradication of pleuro-pneumonia in the United States had prevented the exportation of infected animals or that the English inspectors were more careful in their diagnosis and for the time being stopped reporting cases of broncho-pneumonia as contagious pleuro-pneumonia.

It is not a pleasant task to question the diagnosis of professional gentlemen under any circumstances, but in this case there is no other alternative. It has been asserted for more than ten years by competent English and American authorities that the cattle from this country alleged by the British inspectors to be affected with contagious pleuro-pneumonia were not suffering from that disease, but from ordinary pneumonia, induced by injuries and exposure during the voyage. The answer to this assertion has simply been that the British inspectors know pleuro-pneumonia when they see it, and that, so long as lungs are found in American cattle affected as the ones in question have been, the United States will be treated as a country affected with that disease.

This is a serious commercial question to the United States, and it is also a serious scientific question to the veterinary profession of the world. Are we, as veterinarians, to admit that after the years of struggling with pleuro-pneumonia, after the scientific investigations which have been made, after the thousands of autopsies which we have had an opportunity to witness in eradicating the disease—are we, after all this, to admit, I repeat, that we know so little about the changes caused by it in the affected animal that there is any substantial reason for the differences of opinion which have been expressed by men who stand high as authorities on such questions?

Every veterinary pathologist who has had experience with pleuro-pneumonia must know that there are certain appearances of the lungs in this disease which are peculiar to it, and which, if they were found associated, would immediately disarm criticism as to the diagnosis. On the other hand, it is equally well known that in the absence of these peculiar appearances or pathognomonic lesions, the animal affected can not be pronounced affected with pleuro-pneumonia, unless there is a clear history of exposure to that disease or unless experiments have shown that typical cases of pleuro-pneumonia can be produced in other animals by cohabitation with them. In other words, pleuro-pneumonia can not be properly diagnosed in an animal or a group of animals unless some lesion is found which is peculiar to and characteristic of that disease.

In the whole decade of controversy in which the discovery of hundreds of cases has been claimed, the British inspectors have never produced for the satisfaction of this Government one single lung from an American bullock which presented characteristic lesions of contagious pleuro-pneumonia. This is an important assertion to make, and one the serious character of which is fully appreciated by the writer. Having, however, carefully followed the discussion and the official reports, having seen specimens from a considerable number of the lungs said to be affected with typical pleuro-pneumonia, and having had careful descriptions of the others seen by the American inspectors, this assertion is made with the fullest confidence that it is correct.

With these views, clearly expressed, the history of such discoveries on the English docks will be continued, to include the latest returns which have been received.

From August 16, 1890, to February 1, 1891, not a single case of alleged pleuro-pneumonia was reported. On February 2, 1891, during the temporary absence of the American inspector, a case of pleuro-pneumonia was reported at Deptford, as having been discovered in the lungs of a bullock shipped from New York. On April 15, 1891, two more cases were found among a lot shipped from Baltimore. These were the only cases brought to the attention of the American inspectors during 1891, and these animals, in their opinion, were affected with broncho-pneumonia.

Specimens from these lungs were submitted to Prof. Williams, the eminent veterinarian of Edinburg, who had no hesitation in pronouncing them affected with simple broncho-pneumonia, without any of the peculiar characters of contagious pleuro-pneumonia. The history of the animals in question was also traced in the United States, and it was shown that there was no pleuro-pneumonia in the sections of the country from which they came, and that they could not have been exposed to the contagion on their way to the vessels by which they were shipped.

When the annual report of the director of the veterinary department for the year 1891 appeared, it was found that four cases of pleuro-pneumonia had been charged against the United States. One of these was said to have been found in a shipment from Boston, but the American inspector was neither shown the lung nor notified that this case had been reported.

From August 16, 1890, to January 1, 1892, but four animals from the United States were reported as affected with pleuro-pneumonia. In May, 1891, one of the British inspectors found a lung similarly affected in a Canadian steer, but when this case was brought to the attention of the director of the veterinary department, it was promptly decided to be simple broncho-pneumonia.

In January, 1892, one case of pleuro-pneumonia was reported in a shipment from Boston and two cases in a shipment from Philadelphia. In February one case was reported in a shipment from Baltimore. These animals, according to the American inspectors, were affected with broncho-pneumonia. All of these animals were traced by their tag numbers, and it was clearly established that none of them could have been exposed to the contagion of pleuro-pneumonia previous to their shipment from the United States.

No other cases alleged to be pleuro-pneumonia were brought to the attention of the United States inspectors previous to the issuance of the proclamation of the Secretary of Agriculture declaring the United States to be free from that disease, and to have been free for the previous six months. Immediately after the publication of this proclamation in the newspapers of Great Britain, the British inspectors commenced reporting cases of pleuro-pneumonia, and they have continued making such reports with the most astounding frequency.

Bearing in mind that during two years but eight cases of pleuro-pneumonia, all told, were reported by the British inspectors, we will see what a wonderful stimulus for such discoveries the proclamation of eradication proved to be. This proclamation was issued on September 26, 1892. The number of cases sinces reported by the British inspectors is as follows:

Steamship.	Sailed from—	Date.	Cases.
England	New York	Sept. 22	1
Greece	do	Oct. 11	1
Borderer	Boston	Oct. 21	2
Cufic	New York	Oct. 25	1
Othello	do	Oct. 25	3
Venetian	Boston	Nov. 6	1
Roman	do	Nov. 9	1
Montezuma	New York	Nov. 12	1
Otteman	Boston	Nov. 15	1
Michigan	do	Nov. 22	2
Angloman	do	Nov. 26	2
Sedgemore	Baltimore	Nov. 26	6
Durham City	Boston	Nov. 26	1
Roman City	do	Dec. 11	3
Total			32

This table shows that in two and one-half months since the promulgation of the proclamation declaring the United States to be free from pleuro-pneumonia the British inspectors have reported four times as many cases of that disease among American cattle as they did in the previous two years. Instead of the number of animals reported being at the rate of four per annum, as it had been for two years, it suddenly increased to 150 per annum. No one can pretend that there has been any change of conditions to account for such a sudden and enormous increase in the number of cases of pleuro-pneumonia existing among our export cattle, if we admitted, which we do not, that the cases reported were really of that disease. The number of animals exported has not been measurably increased, and the districts from which they have been purchased have been the same; pleuro-pneumonia has been so thoroughly eradicated that no case of it has been discovered in the United States during the last nine months, and yet, in spite of these facts, the number of affected animals found on the other side has increased 3,700 per cent.

Animals from Canada have been found affected with the same lung disease as has been reported to be pleuro-pneumonia when found in cattle from the United States. Until recently, however, this was passed as simple broncho-pneumonia. Since the greatly increased number of cases have been charged against the United States, a few cases of pleuro-pneumonia have been reported in Canadian cattle. In one case it was alleged that the affected Canadian animal transmitted the disease to other cattle with which it came in contact. It would certainly be interesting to see the character of the lesions which these cases presented. According to Prof. Williams, the disease was broncho-pneumonia and not pleuro-pneumonia.

It is reported in the English agricultural press that all the cattle in this shipment, and all of those which had been in any way exposed to them, were slaughtered at great expense to the Government. As a result, an order has been issued requiring Canadian cattle to be slaughtered on the docks where landed, under the same conditions as cattle from the United States. It may be added, however, that notwithstanding the great danger to the British cattle interests from pleuro-pneumonia in Canadian cattle, which this circumstance would lead one to believe must exist, the order mentioned did not go into effect immediately, but its action was considerately postponed until the shipments for the year had all or nearly all arrived.

It has already been stated that during the ten or more years of controversy no American inspector has ever been shown the lungs of a bullock from the United States, slaughtered in England, which presented the characteristic lesions of contagious pleuro-pneumonia, and it may be added that, in spite of the enormous interests involved, there is no evidence beyond the mere assertion of the British inspectors that a lung with such characteristic lesions coming from an American animal has ever been found by them. It is plain that in this case assertion is not sufficent evidence, for what the British inspectors assert to be characteristic lesions of pleuro-pneumonia the American inspectors assert are the lesions of an entirely different disease. What is needed is the production of one or more lungs taken from American cattle, which present the lesions generally recognized as forming a typical representation of contagious pleuro-pneumonia.

It ought not to be very difficult to agree as to what constitutes such a typical case. It is not necessary to consider the endless controversies which have arisen in the field of pathological histology as to the origin and extension of the disease process, the peculiar microscopical characters, or the varieties of germs which are present. There appears to be little prospect of harmony on these points among microscopists for a long time to come. The macroscopical changes, however, are evident to the eye of every veterinarian; there is practical unanimity in regard to their significance, and we should be able to decide when a lung presents the characteristic and typical appearances of a disease which has been so long known and so carefully studied.

One of the most characteristic features of contagious pleuro-pneumonia is the extent of lung tissue involved and the intensity of the process. The inflammation is not confined to the anterior and inferior portions of the lung, but it extends to all parts of the organ. We may find one-half, two-thirds, or the whole of one lung involved. The affected portion is completely hepatized, very solid, the alveoli, the finer bronchi, the lymph spaces are all filled with exudate; the lung may be cut into slices which are firm, solid, and resistant, and is so increased in weight that a single lung may weigh 30, 35, or even 40 pounds. The pleura are greatly thickened, covered with false membranes, and adherent to the thoracic walls. The pleural cavity contains quarts or gallons of effusion in which float masses of coagulated lymph. The lung on cross-section shows lobules of different color, indicating hepatization of various ages, and the interlobular connective tissue is distended with yellowish lymph, either liquid or coagulated. The veins are found inflamed on their internal surface and plugged with thrombi which are firmly adherent to the diseased surface.

This is the description of a typical case of acute contagious pleuro-pnuemonia, and it requires all of these different features to constitute such a case. Neither hepatization of the lobules, distention of the interlobular connective tissue, nor pleurisy, nor all three combined are characteristic of contagious pleuro-pneumonia. It is impossible to select any one character as pathognomonic, and it is the effort to do this which has created so much confusion and uncertainty. What we insist upon is the combination of characters which together make up the peculiar picture of the lung affected with contagious pleuro-pneumonia. These are, briefly, (1) the great extent of lung tissue involved; (2) the firmness, solidity, and weight of the hepatized tissue; (3) the intense pleuritis, as shown by the thickness of the pleura, the abundance of false membranes, and the quantity of effusion; (4) the difference in age of the hepatization, as shown by the varied colors of the lobules in different portions of a cross-section; (5) the distention and thickening of the interlobular connective tissue; (6) the inflammation of the internal surface of the veins, with firmly adherent thrombi.

Such cases as that outlined above are very common, indeed are the rule in the genuine contagious pleuro-pneumonia of cattle. Why is it that not one single lung affected in this manner has ever been found among the hundreds of cases of alleged lung plague found by the British veterinarians among American cattle?

So much for acute pleuro-pneumonia. The chronic form also has its typical characters, which are well known and easily distinguished. It has been often remarked, and very justly, that, with cattle brought from a pleuro-pneumonia district, chronic cases are more often discovered than acute ones. Why have no chronic cases of pleuro-pneumonia been found among the hundreds of thousands of American cattle shipped to Great Britain since the United States inspectors have been located in that country? Has this mystery ever suggested itself to the British inspectors, and, if so, what can be their explanation of the singular absence of the cases which would be most likely to be found?

In contagious pleuro-pneumonia the plugging of the veins and the intense hepatization which follows lead to necrosis or death of the entire mass of tissue affected. The result is, if the attack is not fatal, that a thick, fibrous cyst-wall forms around the necrosed tissue, and this is preserved in such perfect condition that there are no signs of putrefaction, and the structure and appearance of the hepatized tissue may be made out for months afterward. This condition is typical of chronic contagious pleuro-pneumonia. It is found in the greater part of the animals which have had an attack and recovered. It is the most common lesion found in the lungs of cattle in pleuro-pneumonia districts. If pleuro-pneumonia exists in sections of this country from which cattle are being shipped to England these cysts, with thick fibrous walls, containing great masses of hepatized lung tissue 3 to 6 inches in diameter, should be found even more frequently than the acute form of the disease. How can the singular freedom of American cattle from such lesion be explained?

With such acute cases or such chronic cases of pleuro-pneumonia as are above described there would be no difficulty in making a diagnosis. The acute lesions mentioned are pathognomonic, and if there is any other disease of cattle in which there is encystment of such hepatized masses of lung tissue it must be very rare. But the British veterinarians have not discovered either the acute or the chronic forms of disease above described, and for that reason their diagnosis is contested. The cases of lung disease which they have discovered have varied in character, and to the mind of the writer have evidently been produced by various causes. The most common of these causes have been exposure and injury.

It may be freely admitted that in some of these cases there has been distention of the interlobular connective tissue, with more or less hepatization, and in occasional instances moderate pleurisy. In this, however, there is nothing characteristic of contagious pleuro-pneumonia. Neither in the extent of organs involved, in the firmness and density of the hepatized tissue, in the degree of the pleurisy, in the difference in the age of the hepatized areas, in the width of the connective tissue bands, nor in the plugging of the veins, much less in a combination of these, has there been anything to denote contagious pleuro-pneumonia.

In one of the cases pronounced to be beyond doubt, of which a specimen was forwarded to Washington for examination, the lesion was evidently not extensive, the connective tissue bands were only moderately distended, the coagulated lymph could be easily picked from the meshes in little masses from the size of a pin head to that of a pea, the hepatization was very slight, and the tissue of the affected lobules still quite spongy, while the thickening of the pleura was scarcely more than visible. This was the first case reported after the publication of the proclamation of the Secretary of Agriculture declaring the United States free from the plague. It was widely heralded through the press as a typical case. In the majority of cases the lesions, according to the reports of the American inspectors and of Prof. Williams, are those of broncho-pneumonia.

Croupous pneumonia, interstitial pneumonia, and broncho-pneumonia are conditions which have long been described and are still recognized by veterinary authorities as liable to occur in cattle without any connection with contagious pleuro-pneumonia. No one can successfully contest the independent occurrence of these lesions, and there certainly could be no conditions in the surroundings more favorable to their production than obtain on board ship during the cold months of the year, when storms, high winds, and extremely low temperature are common.

When cattle have been exposed alternately to the close hot atmosphere between decks when the hatches and port holes were closed, and then to the abundant and cold drafts of air when these were thrown open in the season of storms and extremes of temperature, it is not surprising that a small proportion of them, scarcely ever reaching 1 per cent in any shipment, should show lesions of croupous, interstitial, or broncho-pneumonia. Indeed, it would be amazing, and far different from our experience on land, if these conditions did not produce such lesions in the lung tissue. During the two and one-half months in which the thirty-two cases of alleged pleuro-pneumonia were reported, about 71,000 head of cattle were exported, the lung lesions being therefore found in one animal out of about 2,200 landed. Such a small proportion of affected animals is inexplicable with a contagious disease, when we consider that the animals of each lot are crowded together for fully four weeks before slaughter.

It ought to be plain to any veterinarian that he is not justified in deciding an animal to be affected with contagious pleuro-pneumonia when he has only found the appearances or lesions in the lungs which are known to result from croupous, interstitial, or broncho-pneumonia. If such an animal came from a stable where pleuro-pneumonia was known to exist, that disease might be diagnosed, but then the diagnosis is made upon the history and not upon the lesions. The writer is perfectly aware that in eradicating pleuro-pneumonia in various countries it has been the rule to consider nearly all cases of acute lung disease as possible cases of pleuro-pneumonia and to act as if they were such. Here again the decision is based upon the knowledge of the existence of the disease and the possibility of contagion; in other words, upon the history of the district.

In a district where pleuro-pneumonia was unknown, or in one where the disease had been eradicated, it certainly would not be considered proper by any veterinary sanitarian to impose quarantine and slaughter because an isolated bovine animal had been found there with the lesions of croupous, interstitial, or broncho-pneumonia. Under such circumstances it would be necessary to search for a typical case of contagious pleuro-pneumonia, or to obtain facts showing undoubted contagion, with somewhere in the chain an animal showing the typical characters of the disease in question.

The necessity of a typical case of pleuro-pneumonia is insisted upon because contagion is often suspected where it does not exist. A large number of cows may all be exposed to the same draft of cold air, and 25 per cent of them may contract broncho-pneumonia. One man would say, so many cases of lung disease in a stable indicates contagion, while another, recognizing the true cause of the trouble, would properly diagnose it as a noncontagious affection.

Furthermore, there is a form of pneumonia in cattle, probably worldwide in its distribution, associated with a certain microörganism, and liable to occur in several animals at the same time. The infectiousness or contagiousness of this disease are matters of doubt, as are the pneumonias of man associated with similar microörganisms; but if there is any power of dissemination it must be very slight, and then only among animals subjected to the same causes favorable to the development of pneumonia, because when affected animals are mixed with healthy ones under proper sanitary conditions, the disease is not conveyed.

These several diseases may be expected from time to time among cattle landed in England from the United States. But in none of these diseases are the typical lesions of contagious pleuro-pneumonia found, and it is an error to consider them allied to or identical with that disease. These diseases, common to the whole world, will be found in a certain proportion of cattle shipped either from America to England or from England to America, as long as the transatlantic trade in live cattle continues. Such isolated cases should be easily diagnosed by competent inspectors, and should not be allowed to interfere eternally with an important trade when there is no danger connected with them. There is a scientific aspect to this question as well as a political one, and science should not be modified to suit political requirements. The veterinary profession has the knowledge by which it can discriminate between contagious pleuro-pneumonia and other diseases affecting the lungs, and that there should be such a difference of views in regard to the disease found in American cattle landed in England can only be explained upon the hypothesis that one side or the other is not forming its opinions in accordance with such knowledge.

The statement of the case has been confused and covered with intricate discussions as to whether this or that special feature was or was not pathognomonic of contagious pleuro-pneumonia or of some other disease. Such discussions serve to pass away the time and to furnish some apparently scientific grounds for the advocates of each position to stand upon. There is, however, no prospect of any practical results being reached in that way.

There is no one character which in the present condition of knowledge surely indicates contagious pleuro-pneumonia, but taking the various characters together as they exist in a typical case of the acute disease, a picture is formed which can not be mistaken. Stress has been laid in times past upon the distention and thickening of the interstitial connective tissue bands; upon the marbling caused by the contrast in color between the yellow bands and the areas of red or nearly black parenchymatous tissue surrounded by them, and upon the concomitant enlargement of the lymphatic glands. It is now known, however, that all of these conditions may occur independently of contagious pleuro-pneumonia.

The marbling in color, which is now referred to as characteristic, is due to areas of inflammation of different age, and has been accepted as pathognomonic on the theory that contagious pleuro-pneumonia is the only disease of the bovine lung which progresses by gradual extension from one section of the lung to other parts of it. But admitting, as we must from recent investigations, that there are other inflammations of the lungs of cattle, associated with and which may be produced by microörganisms, what is more reasonable than to suppose that these microörganisms may begin their multiplication in one section of the lung and penetrate by degrees to other sections? In such a case there would be found hepatization of different ages in the various parts of the lung. Again, in ordinary croupous pneumonia the lobules are often of varying color, owing to more or less hemorrhage in the different regions, and this variation of color is sometimes mistaken for the variation due to hepatization of different ages.

The inflammation of the internal coats of the veins, and the firmly adherent thrombi, may be a more characteristic lesion; but the writer is not inclined to accept this character by itself as surely indicating contagious pleuro-pneumonia until more extended observations have been made.

The conclusion which we must reach is, therefore, that to diagnose pleuro-pneumonia safely we must have a typical case of the disease combining the different changes which have been enumerated. Unless these characters are all present we are not justified by the lesions in declaring a district, much less a whole country, to be infected with contagious pleuro-pneumonia. It may be true that every case of contagious pleuro-pneumonia is not typical, and that the lesions in such cases resemble those of broncho-pneumonia or interstitial pneumonia, but all that can be said in regard to these cases is that under such circumstances contagious pleuro-pneumonia can not be diagnosed from the lesions. We must then rely upon the history of the case to confirm or disprove our suspicions. Where cases are reported among imported cattle by the inspectors of a country at the rate of three a week, there should be no difficulty in discovering the typical lesions of the plague, in case the plague exists.

It is unfortunate that this whole question has been plunged into still deeper polemical complications by the alleged discovery in Nebraska of a hitherto undescribed pneumonia which has been designated "the cornstalk disease," and which it is assumed is the same disease which has been discovered in the lungs of American cattle abroad. The breaks and inconsistencies of this theory are such as should have led any scientist to have hesitated a long time before accepting it, and yet eminent authorities have gravely discussed it as though it were an established fact for eighteen months, and they only now begin to discover some of its serious defects.

In the first place, this theory would require us to discard the action of cold and exposure as factors in the pneumonias found among our cattle shipped across the Atlantic. These are, however, the most obvious causes of the different forms of sporadic pneumonia, and as nearly all of the cases have been found in the cold months of the year it would be absurd to claim that none of them were due to extremes of temperature.

In the second place, but three cases of lung disease found among cattle which had been feeding upon cornstalks have been offered to demonstrate this theory which is to revolutionize our knowledge of the lung diseases of cattle. This certainly is a very insufficient amount of material upon which to found a theory, much less to expect its immediate adoption by the entire world.

In the third place, the conclusion that a form of pneumonia is produced among cattle by feeding upon cornstalks is purely hypothetical. There is a disease in cornstalks produced, according to Burrill, by a motile bacillus, and it is assumed that this bacillus in some unaccountable way acquires virulence by the drying of the cornstalk and produces the disease in cattle known as the cornstalk disease. There is then another assumption that the interstitial pneumonia found in three instances is identical with the cornstalk disease. It should also be noted that the author of this theory did not see one of the animals alive, nor did he conduct the autopsies upon them.

In the fourth place, the assumption that the disease seen among American cattle in France was identical with the cornstalk disease of Nebraska was not consistent with the facts and very improbable. Nocard was of the opinion that these cattle were affected with a form of pneumonia which did not exist in France, and as he discovered a bacterium associated with the disease, which he took to be motile, he jumped to the conclusion that the disease which he had under observation was identical with the cornstalk disease of Nebraska. There is no evidence that these cattle had been feeding in "stalk fields, or upon snap corn with the husks on"—conditions which are laid down as essential to the production of the malady; but, on the contrary, the presumption would be that export cattle had not been so fed. More important still is the assertion of the discoverer that the bacillus of the cornstalk disease is actively motile, grows upon potatoes, and has other characteristics which demonstrate that, whatever may be its nature, it does not belong to the rabbit septicæmia group of microörganisms. On the other hand, I have been furnished, through the kindness of M. Nocard, with cultures of the germs discovered by him in American cattle, and can assert positively that they are not motile, do not grow upon potato, and that they belong to and have all the characters of the rabbit septicæmia group. This is sufficient to show that the diseases are not identical, and that the superstructure of theory built upon this assumption can not be maintained.

In the fifth place, disease with the same lesions has been observed by Williams among English and Irish cattle. It was recognized by him in the lung of the Canadian animal killed at Lindores in Fife. It has also since been seen among French cattle by Nocard associated with the same germ he found in the American cattle. For my own part, I have frequently seen the disease in our Eastern States, in cows shipped from districts where there had been no pleuro-pneumonia, and where they do not feed cattle in stalk fields or upon snap corn with the husks on. The disease in question is not the result of feeding upon any particular kind of food, but is a common form of broncho and interstitial pneumonia, as asserted by Williams, and when other European authorities follow his example and study the forms of pneumonia in cattle which occur in their own countries, they will have no difficulty in recognizing it.

VESSEL INSPECTION.

The inspection of vessels carrying export cattle has been maintained during the year under the act of Congress approved March 3, 1891, to insure the safe transportation and humane treatment of cattle on their voyage across the Atlantic. The total number of vessels inspected during the year was 917, of which 382 sailed from the port of New York, 240 from the port of Boston, 153 from the port of Baltimore, 78 from the port of Philadelphia, 35 from the port of Newport News, 5 from the port of New Orleans, and 24 from the port of Portland, Maine. There has been a marked improvement in the fittings and ventilation of most of the vessels carrying cattle, and this has resulted in the animals reaching their destination in better condition, and also in a diminished loss at sea. The percentage of loss of cattle during the voyage, including all causes, was only seven-eighths of 1 per cent. As the loss during 1891 was 1$\frac{5}{8}$ per cent, a marked improvement is shown by this report.

MEAT INSPECTION.

At the time my report for last year was written, inspection was being made of the products of twenty-two abattoirs, under the act of Congress approved March 3, 1891. At the present time the number of establishments provided with meat inspection has been increased to thirty-eight, and arrangements are being made to extend the inspection still more. The total number of animals examined under the Department regulations of March 25, 1891, and the products of which have been marked for identification in the manner prescribed in the regulations, was for the fiscal year ending June 30, 1892, 5,076,929. Of this number 3,167,150 were cattle, 1,267,329 were hogs, 583,361 were sheep, and 590,899 were calves. There were 1,990,771 quarters of beef tagged for export and 8,160,625 for the interstate trade, while 688,176 carcasses went to canning establishments. There were stamped and marked for identification, in accordance with the regulations, 797,707 packages of canned, salted, and smoked beef products. Of the 3,167,150 head of cattle inspected, 141 were condemned on ante-mortem examination, and 1,914 on post-mortem examination. Of 583,361 sheep, 197 were condemned on post-mortem examination. Of the 1,267,329 hogs inspected microscopically, there were found 25,899 infected with trichinæ. The following table shows the work in detail for the period ending June 30, 1892:

Meat inspection work, fiscal year ending June 30, 1892.

Number cattle inspected	3, 167, 150
Number diseased on inspection	141
Post-mortems made	3, 167, 009
Number diseased	1, 914
Dressed quarters for export	1, 190, 771
Dressed quarters for interstate trade	8, 160, 625
Carcasses to other establishments than were examined	627, 237
Packages of canned meat stamped	495, 577
Packages of salted meat stamped	142, 698
Packages of smoked meat stamped	159, 432
Number hogs inspected	1, 267, 329
Number diseased with trichinæ	25, 899
Packages of salted pork, bacon; and hams stamped for export.	76, 266
Number sheep inspected	583, 361
Number diseased	197
Dressed carcasses for export	383, 157
Calves inspected	59, 089
Number certificates issued	5, 783
Total number of animals examined	5, 076, 929

EXPORTATION OF INSPECTED PORK PRODUCTS.

The first decree removing the prohibition against the importation of American hog products into any of the European countries was made in September, 1891. From that time until the close of the fiscal year ending June 30, 1892, the Department issued certificates for 76,911 packages of pork products, containing 38,152,874 pounds. The following is a table showing the exports of inspected pork products to June 30, 1892, giving the countries to which the same were exported, respectively:

Statement of number of cases and weight of pork products exported for the fiscal year ending June 30, 1892.

Country.	Cases.	Pounds.
Germany	39, 355	19, 627, 726
Belgium	14, 098	7, 141, 946
Holland	8, 345	4, 279, 416
France	3, 432	1, 645, 625
England and Scotland	9, 567	4, 399, 675
Denmark	1, 238	671, 697
Italy	156	75, 713
Norway and Sweden	610	306, 139
Spain	10	4, 937
	76, 911	38, 152, 874

The exports in the above table credited to Belgium and England and Scotland probably found their way to the German and French markets, as they were forwarded to houses in Belgium and Great Britain for orders from French and German merchants. We may, therefore, conclude that practically all inspected pork certified to by the Department went either directly or indirectly to those countries which have lately removed their decrees of prohibition against the importation of Amercan pork. While the direct effect of the removal of the prohibition by foreign countries, obtained by reason of the system of meat inspection inaugurated in this country under the act of Congress approved March 3, 1891, has been to find a market in such countries for 38,152,874 pounds of bacon, hams, and pork, the indirect effect has been to increase our exports to all European countries to a large extent. The mere fact of the removal of the decrees of prohibition was to reëstablish confidence in the purity of our pork products, which had been seriously damaged by reason of these decrees made in the latter part of 1881 and subsequently.

For the fiscal year 1881, just prior to the imposition of these decrees of prohibition, the total exportation of hog products from the United States to foreign countries amounted to $104,660,065. For the fiscal year 1883, after these decrees went into effect and their influence was fairly felt, our exports amounted to but $70,966,268, being a loss of $33,693,797 in the values of our exports for 1883 as compared with 1881. Of this loss the proportion chargeable directly to Germany and France was $11,624,884, leaving a loss of $22,068,913 as the loss to be accounted for in such portions of the exports taken by Germany and France through the channels of commerce entering from other countries, and by the loss of confidence in other countries caused by these prohibitory decrees.

It is early yet for our export trade in these products to feel the full effect of the restoration of confidence in the wholesomeness of our pork, but we are beginning to feel the first effects of such confidence, and a comparison of our export trade of the last four months with the exports of a like period of the preceding year will show a gratifying improvement. The following is a table giving the quantity and values of pork products exported to all European countries for the months of May, June, July, and August, 1892, as compared with the exports for the same months of the year 1891:

Statement showing the quantities and values of our pork products exported to all countries in Europe during the months of May, June, July, and August, 1892, as compared with the exports for the corresponding months of 1891.

Month.	Quantities.		Values.		Increase for 1892.		Percentage of increase for 1892.	
	1891.	1892.	1891.	1892.	Quantities.	Values.	Increase in quantities.	Increase in values.
	Pounds.	*Pounds.*			*Pounds.*		*Per ct.*	*Per ct.*
May	46,975,161	82,086,866	$3,613,324	$6,333,007	35,111,705	$2,719,683	74¾	75¼
June	46,558,489	85,741,208	3,575,006	6,632,868	30,182,719	3,057,862	84⅘	85½
July	59,320,966	83,831,502	4,637,502	6,746,523	24,510,536	2,109,021	41⅓	45½
August	54,142,072	84,039,342	4,130,520	6,878,156	29,897,270	2,747,636	55⅕	66½
Total	206,996,688	335,698,918	15,956,352	26,590,554	128,702,230	10,634,202	62⅕	66⅔

It will be seen from the foregoing table that the exports of our pork products for the four months of 1892 have been 128,353,731 pounds over the exports for the same period in 1891, or an increase of 62 per cent, while the increase in values for 1892 has been $10,634,802, or an increase of 66⅔ per cent. The increase in values is greater than the increase in quantity, for the reason that the prices for 1892 have been higher than the prices for 1891. The work of meat inspection has more than justified the sanguine hopes of its promoters and fully warrants the comparatively small expense incurred by the Government for its maintenance.

DIVISION OF ANIMAL PATHOLOGY.

The work of this division includes all scientific investigations in regard to the nature, prevention, and treatment of animal diseases.

The most important work of the year has been the completion of the investigations as to the nature of the Texas or splenetic fever of cattle, and the way in which the infection is carried and transmitted by animals from the infected district. This investigation has been extremely successful, and the mysteries connected with the spread of this disease are now satisfactorily explained. A special report upon the subject has been prepared.

The study of this disease, which has caused losses of great magnitude in the past, may justly be regarded both from a scientific and practical point of view as among the most important researches ever undertaken by the Department. The successful elucidation of the character of this disease makes it possible to intelligently formulate measures for its prevention and control.

On account of the continued declarations of the British inspectors that cases of contagious pleuro-pneumonia were frequently discovered among American cattle landed in Great Britain, considerable time has been given to the study of various forms of pneumonia in cattle. It has been deemed essential, therefore, that the different affections of the lung to which cattle are subject should be described and illustrated more carefully than heretofore, in order that any grounds for difference of opinion from a scientific point of view may be removed. The work of the year on such diseases has been of a preliminary character, with a view of making a convincing scientific report on the whole question.

Much scientific work has also been done in connection with the diseases known as tuberculosis and glanders. The losses from these diseases and their danger to human health and life make it extremely desirable that something should be done for their control. The great obstacle in the way of measures for this object has been the difficulty of diagnosing these diseases except with certain animals which are plainly affected. For example, in a herd of forty cattle three or four may be plainly affected with tuberculosis, four or five others may be suspicious, and some others which are actually affected may show no symptoms of the disease. It is evident that under such circumstances it would be necessary either to destroy the whole herd or to leave some affected animals to propagate the contagion. The same is true of glanders in horses.

Recent investigations show that the germs of these two diseases produce, during their multiplication, a chemical substance which, when properly administered to affected animals, increases their temperature so remarkably as to almost invariably reveal the presence of the malady even in the first stages. Experiments have been made to determine the best method of obtaining these valuable bacterial products in sufficient quantities to be used for the purposes mentioned. These experiments have been successful, and if Congress deems it best to authorize the Department to adopt measures for the control of either tuberculosis or glanders, or of both of these diseases, the laboratory of the Bureau is now in condition to supply this indispensable diagnostic agent.

Researches of great value have also been made in regard to the varieties and life history of the parasites affecting the domestic animals in this country. Many new species have been studied and their connection with various diseases has been traced. This is a wide field of investigation from which most important practical results may be confidently predicted. With the single exception of the Special Report on the Diseases of the Horse, there has been no more popular report issued from this Department than that on the Animal Parasites of Sheep. The numerous requests for this little volume, which are far beyond the ability of the Department to supply, demonstrate the widespread interest in the subject. Other reports of this nature are in preparation, but as the whole field must be worked over scientifically on account of the present lack of accurate knowledge, the progress is necessarily slower than with subjects which have received more attention from the scientific world.

The laboratory of the Bureau has also been engaged upon questions relating to the prevention of swine diseases, and in coöperating with the Division of Field Investigations to determine the nature of outbreaks of disease among all classes of animals in various sections of the country. There are many demands for this class of work, and it is usually of such an urgent nature and so important withal, that it must be given constant attention.

DIVISION OF FIELD INVESTIGATIONS AND MISCELLANEOUS WORK.

The work of this division was fully described in my report for the year 1891. Briefly stated, it consists in conducting the investigations in the field as to the nature of diseases affecting animals in different sections of the country, in collecting information as to the condition and needs of the animal industry, in replying to inquiries for information on subjects which come within the sphere of the Bureau work, and in supervising the expenditures and accounts of the whole Bureau.

QUARANTINE DIVISION.

Stations detaining cattle, sheep, and other ruminants, and swine imported from across the ocean, are maintained at the ports of Boston, New York, and Baltimore. The outbreak of foot-and-mouth disease in Great Britain, which began early in February, 1892, and which spread rapidly in spite of the preventive restrictions that were adopted, made it necessary to exercise the utmost vigilance at the quarantine stations, and finally to decline to issue permits for the importation of animals from affected countries until the disease had been suppressed. This caused a suspension of the importation of sheep from Great Britain for the greater part of the year; but as the disease was finally eradicated, permits for importation are again being issued. Foot-and-mouth disease does not exist in the United States and has not been in this country since 1884, and as pleuro-pneumonia has been eradicated after a long effort and with great expense, the necessity of a most rigorous system of inspection and quarantine is apparent to prevent the reintroduction of such plagues.

The quarantine stations are well supplied with buildings and fences, and the expense of keeping them in condition is very small. The animals recently imported and quarantined have been mostly sheep. The numbers which have passed through the stations for the fiscal year are as follows: Cattle, 36; sheep, 1,051; swine, 2; goats, 14.

No case of the importation of a dangerous disease has occurred during the year.

PUBLICATIONS.

It is with pleasure that I call attention to the "Special Report on the Diseases of Cattle and on Cattle Feeding," just issued by this Bureau, which is written on the same general plan as was the "Special Report on Diseases of the Horse," a work which has proved to be the most popular publication ever issued by the Department. The high class of the articles which comprise this second volume of the series on the diseases of farm animals and their scientific yet popular character make it of the greatest value to our farmers, and will certainly give a new impetus to the progress of veterinary science in the United States.

There is also just ready for distribution a magnificent "Special Report on the Sheep Industry of the United States," which treats exhaustively of the formation of our flocks, their management and improvement, and the present condition of the industry. This volume has been written with the object of gathering together the information indispensable for intelligent sheep-breeding which has been heretofore, for the most part, inaccessible. There is already a large demand for the work, and there can be no doubt that when it has been carefully examined by those interested in the sheep business it will prove to be an extremely valuable and popular publication.

There is also going through the press a "Special Report on Texas or Splenetic Fever of Cattle," which contains the results of the scientific investigations of this disease. These investigations have been remarkably successful, demonstrating that the disease is caused by a parasite which lives in the red corpuscles of the blood, and that this parasite is generally, if not always, carried to affected animals by ticks.

Such an intricate mode of transmission is very rare if it exists with any other disease, and the fact that the microscopic parasite may be transmitted through the egg from one generation of ticks to another serves to make the whole question still more complicated. The success in clearing up these and many other points, necessary to an understanding of the way in which the malady is transmitted, is one of the best examples of the value of the intelligent application of modern science for solving the mysteries of nature which in various ways affect our agricultural practice. That this disease is now understood and that the measures for its prevention may be hereafter placed upon a scientific basis is a matter for congratulation, both from a scientific and practical point of view. It should certainly be an encouragement to continue such investigations until the many other questions which are pressing upon us for solution can be disposed of in an equally satisfactory manner.

INVESTIGATION OF INFECTIOUS DISEASES OF DOMESTICATED ANIMALS.

By Dr. THEOBALD SMITH, *Chief of Division of Animal Pathology.*

These investigations have been continued along several lines during the year, as may be seen from the brief summary given below. The difficulty inherent in the study of these diseases is due partly to the perishable nature of the material which requires investigation; partly to their wide distribution and their occurrence at long distances from laboratories where much of the real study must be carried on; partly to their prevalence during certain short periods of the year. All these circumstances combined make it essentially necessary to carry on a number of investigations at once and to concentrate our forces on that disease which presents for the time being the greatest opportunities. It is also for the reasons given above that investigations may extend over a number of years before sufficient information has been collected to warrant its publication. Whenever possible, efforts are made to reproduce diseases at the veterinary experiment station near Washington, where both field and laboratory investigation may be brought to bear upon them. This is not always feasible, however, for many diseases of domesticated animals are either confined to certain restricted localities, or are associated with conditions which can not be reproduced artificially. In such cases the investigations must go on, often under great disadvantages, with much loss of time and with the prospects of uncertain results, because of the want of proper facilities.

TEXAS CATTLE FEVER.

The field investigations concerning the causation of this disease have been carried on from July to November of the past year.* At the same time a special report or bulletin has been prepared, which includes the details of the experimental work from 1888 up to the present. This bulletin contains chapters on the nature of Texas fever, its symptoms and pathological changes, and on the microörganism which produces it. It also contains chapters on the life history of the cattle tick and its precise relation to the disease; on immunity and preventive exposures; on the infectiousness of sick natives; and on the probability that Texas fever is a cosmopolitan disease, limited in its distribution by latitude rather than by continents. The practical deductions are brought together in a final chapter which, owing to its importance, is incorporated in part into the present summary. In the following pages a brief account of the work of the year is given. For detailed proof of the statements made the reader is referred to the bulletin reproduced further on in this volume.

THE CATTLE TICK THE CARRIER OF TEXAS FEVER.

In the investigations carried on up to 1892 the precise relation of the cattle tick to the disease had not been positively demonstrated. It was known from our former experiments that young ticks placed on susceptible cattle produced Texas fever. It was also shown in 1889 that when the ripe tick was prevented from falling to the ground, and a future generation was thereby destroyed in the egg, so to speak, the disease did not appear. Owing to circumstances the confirmation of this important experiment was delayed until this year. Prior experiments in 1890 and 1891 had failed because the ticks had not been entirely removed. During the past summer, however, the fact was again demonstrated that when ticks are removed (picked off by hand) from Southern animals, the latter may freely mingle with susceptible Northern cattle without communicating Texas fever. Two experimental fields were set aside for this purpose. In each two Southern and two native animals were placed. From the Southern animals the ticks were picked off, as far as possible, just before they were placed in the field. They were examined from day to day for several weeks to remove any that had escaped notice, owing to their small size. In the general control field containing Southern animals from the same farms from which the ticks were not picked off all exposed natives were attacked with Texas fever, while in the two fields mentioned no disease appeared, although the blood of the exposed cases was carefully examined from time to time, so that no mild, transient attack should escape our attention.

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* This work was done with the coöperation of F. L. Kilborne, B. V. S., and E. C. Schröeder, M. D. V.

Experiments with the cattle ticks have thus been carried on in three different directions:

(1) Adult egg-laying ticks have been scattered on pastures, and the natives placed on such pastures have contracted Texas fever in the absence of Southern cattle.

(2) Eggs have been incubated in the laboratory, and the young ticks placed on native cattle have produced the disease.

(3) When the cattle tick is prevented from attacking native cattle by being removed from the Southern cattle before it falls to the ground and lays its eggs, Southern and native cattle may freely mingle without the appearance of Texas fever.

These three lines of investigation point to the cattle tick as the carrier, and the only carrier, of Texas fever; yet we do not wish to maintain that the Texas fever virus may not be occasionally transferred through other still unknown channels. A case was referred to in the preceding report (1891), which gives some support to the assumption that this disease may be at times conveyed without ticks. On the whole it is safe to maintain that if Texas fever is transmitted without the tick, such transmission will probably be confined to one or a few animals and not become epizoötic, since every fact relating to the disease, especially the period of incubation, points to the tick as the exclusive carrier of the infection, so far as the territory north of the permanently infected region is concerned.*

THE TEXAS FEVER MICROPARASITE LIVES IN THE BLOOD OF HEALTHY SOUTHERN CATTLE.

The tick as the carrier of the Texas fever micro-parasite might perhaps be regarded at first thought as the true and only host of this organism, and that Southern cattle being insusceptible had little or nothing to do with the infection. This is not true, however, for the experiments of the past summer revealed a quite different condition of things. It was found on injecting the blood of Southern cattle into the veins or under the skin of Northern cattle that this blood produced Texas fever in the absence of ticks. Not only was the blood capable of producing disease when the cattle were fresh from the Southern pastures, but even after they had been deprived of ticks for several months. In one case (a North Carolina cow brought to the station in 1889), the blood was capable of producing Texas fever though the animal had been away from Southern pastures for three years.

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*These results have thus far been tested and confirmed by R. R. Dinwiddie, veterinarian of the Agricultural Experiment Station of Arkansas. Bulletin 20, November, 1892.

These facts make it all the more strange that Southern and native cattle may mingle on the same pasture and yet no disease appear when ticks are absent, although the micro-parasite of the disease is carried about, in exceedingly small numbers to be sure, by Southern cattle in their blood, and although it requires the transference of only a small amount of blood to start the disease among the natives.

PREVENTIVE EXPOSURE.

In the course of our investigations it was shown that native cattle passed through both mild and severe attacks and made a perfect recovery. By reëxposing such animals once or twice on succeeding summers certain general conclusions were reached concerning the possibility of exposing natives purposely to induce insusceptibility. The results warrant the general statement that there is acquired more or less insusceptibility after exposures. Thus, an acute attack is not followed by another acute attack, but the second exposure may be negative or lead to a mild form of the disease. A mild attack in fall may be followed by an acute attack the following summer, which, in some cases, may be fatal. It is probable that two mild exposures in two successive years may make the animal secure against a subsequent fatal attack, and it is possible to grade the severity of the attack, as is pointed out in the bulletin referred to, so as to prevent any deaths from occurring. This subject is again referred to in the following pages.

PREVENTION.

Texas fever, in the territory outside of the enzoötic region, is the result of the distribution of ripe egg-laying ticks by cattle from the enzoötic region. Hence, such cattle should not be allowed on uninfected territory during the warmer half of the year. It is also evident that during the same period all cars carrying Southern cattle contain a larger or smaller number of ticks which have dropped off during the journey and which are ready to lay their eggs. The sweepings of such cars, wherever deposited, may give rise to a crop of young ticks, and these, when they have access to cattle, will produce the disease. Wherever Southern tick-bearing cattle are kept within twenty-five to thirty days after their departure from their native fields, they are liable to infect such places, since it requires the period mentioned for the smaller ticks to ripen and drop off. But under special conditions even this period is too short, and the Southern cattle may remain dangerous a longer time. This would occur when such cattle remain in any one inclosure long enough (four to five weeks) for the progeny of the first ticks which drop off to appear on the same cattle.

The above points are covered in the regulations of the Department of Agriculture concerning cattle transportation. These regulations insist on the complete isolation of cattle coming from the permanently infected territory, between March 1 and December 1 of each year, and on the proper disinfection of the litter and manure from such cattle during transportation. Furthermore, such cattle can only be transported into uninfected territory for immediate slaughter during the prescribed period. These regulations, if properly carried out, would prevent the appearance of Texas fever at any time in those areas north of the enzoötic territory.

The only question which now presents itself is the efficiency of the prescribed disinfection. It has been shown that the infection resides only in the cattle ticks and their eggs; hence the destruction of these is absolutely essential to make the disinfection of any value. In the present report this question has not been touched upon; therefore, pending the trial of various disinfectants which is now going on, any discussion or any suggestions are of little value.

The harmlessness of Southern cattle, after being deprived of the cattle tick, brings up the very important question whether such cattle can not by some means be freed from ticks, so that their transportation may go on without any restriction during the entire year. There are several ways in which experiments might be undertaken. Cattle might be subjected to disinfecting washes of various kinds, or else they might be run through disinfecting baths which expose the whole body to the action of the liquid used. Such processes would require careful attention. The survival of a very few ticks might lead to serious consequences, since a single ripe tick averages about 2,000 eggs.

Cattle may be deprived of ticks on a large scale without the use of any disinfection, if the following plan be adopted: Two large fields in a territory naturally free from cattle ticks are inclosed. The tick-bearing cattle are put into the first inclosure and kept there about fifteen days. They are then transferred to the second inclosure for the same length of time. Thirty days after the beginning of their confinement they may be considered free from infection. The reason for this procedure is simple enough. The cattle drop the ticks as they ripen in the inclosures. By being transferred to a second (or even a third) inclosure they are removed from the possible danger of a reinfection by the progeny of the ticks which dropped off first. It is evident that such inclosures can only be used once a season, since the young ticks subsequently hatched remain alive for an indefinite length of time on the ground. Such inclosures must not be located where there is a possibility that the ticks might survive the winter.

For cattle which are introduced into the enzoötic territory two modes of prevention may be adopted. Either they are kept entirely free from ticks by confinement in stables or upon pastures known to be free from ticks, or else they are exposed to the infection in such a way as to become insusceptible to it after a time. The first method is open to the objection that ticks may at some time accidentally gain access to such cattle and produce a fatal disease. On the other hand, the second method seems the more rational provided it can be successfully carried out. We know that Southern cattle are insusceptible to the disease. Young animals also seem to be largely proof against a fatal infection, although they are by no means insusceptible. The repeated mild attacks to which they are subjected finally make the system indifferent to the virus. The introduction of young animals into the permanently infected territory, though not without danger, is far safer than the introduction of animals older than one year. The danger of a fatal infection increases with the age of the animal and is very great in cows over 5 or 6 years old, as is distinctly shown by the experiments recorded in this report.

The subject of preventive exposures has already been alluded to. It has been shown that while in general two mild attacks may not prevent a third attack, this will not be fatal. One very acute attack will usually prevent a second severe attack. Hence it is possible to prevent cattle, even when fairly along in years, from succumbing to a fatal attack by several preliminary carefully guarded exposures to a mild infection. This infection may be produced by scattering ripe ticks in an inclosure or by placing young ticks on cattle in the fall of the year. Protective inoculation of this kind should be carried on at some locality outside of the enzoötic territory carefully chosen for the purpose. A few years of careful experimentation would probably lead to an efficient method, which, when definitely formulated in all its details, could be applied in different parts of the country. Such experimentation should, of course, pay special attention to the relative susceptibility of the various higher grades of cattle—a matter which we have been unable to touch upon thus far.

What can the individual farmer or stock-owner do in the event that Texas fever has been introduced into his pastures? From what has been said thus far pastures which have been infected by Southern cattle or ticks from the litter and manure of infected cattle cars should be avoided during the entire summer season. While we know that young ticks may remain alive in jars for two or three months without food, it would be premature to conclude that such is the case on pastures, as the conditions are quite different. Yet everything seems to point to a long sojourn of young ticks on infected fields, and, pending the carrying out of experiments to test this question, we would recommend that native cattle be not allowed to graze on infected fields until after the first frosts, for even a mild attack in fall, before the ticks have been destroyed by frosts, is debilitating to cattle. The period of time during which infected localities remain dangerous varies, of course, with the latitude, and would be shorter the colder the climate.

The infection of stables, stalls, and other structures with ticks should be counteracted by thorough disinfection. The adult ticks and the eggs must be destroyed. As stated above, we know as yet very little concerning the agents which will destroy the vitality of the eggs of ticks, but the use of water near the boiling point may be sufficient, if liberally applied, to destroy the life of the embryos. In the case of litter and manure heaps, the thorough saturation with some strong mineral acid in dilution may accomplish the purpose. Ordinary lime, slaked or unslaked, densely sprinkled over infected places so as to form a continuous layer, may be recommended. The slow incrustation of the egg masses with carbonate of lime may be expected, provided the manure is under cover. Otherwise it will be washed away and may leave the eggs unharmed. In regions outside of the enzoötic territory, the absence of ticks may be accounted for by the severity of the winter; hence, in unprotected localities, disinfection is unnecessary after the winter has set in. But it may occur that in sheltered places the eggs will winter over and the ticks reappear the following spring. Hence all infected material should be freely exposed to the frost, even though treated with disinfectants beforehand.

TREATMENT.

If the disease is suspected in a herd, the animals should be searched thoroughly for the presence of small ticks, and the temperature of every animal taken with a clinical thermometer, with which every stock-owner should be provided. This, which should be 5 inches long, is inserted well into the rectum and held there three to five minutes. If the temperature is 104° to 107° F., fever is present. The combination of ticks and fever, or the presence of the former in a locality where they do not naturally exist, may be considered a sure sign of the imminence of Texas fever. Though there are at least two species of ticks regularly infesting cattle in the permanently infected territory, these remarks can apply only to the species described in the bulletin (*Boöphilus bovis* Riley, Curtice), since we know nothing as yet of the fever-producing capacity of the other species (*Amblyomma unipunctata*).

In case the ticks are found on the cattle they should be carefully removed and the cattle transferred at once to uninfected grounds. They should be repeatedly examined for ticks and all found destroyed. While the change of pasture and the removal of ticks may not prevent the attack nor cut short the disease after it has once shown itself, we feel certain that fewer animals will succumb to the disease. A single infection is sufficient to cause severe and prolonged disease, as is shown by the injection of infected blood; but the mortality seems to be lower than in natural exposures, where the infection is intensified with every additional tick.

We are unable to recommend any specific remedies to be applied after the disease has appeared, because none have been tried as yet. Quinine and its various preparations, fed or injected under the skin, may prove of value in destroying the parasite, or perhaps methylene blue, recently recommended for malaria, may be of some service. We hesitate, however, to do more than suggest these remedies, since their efficiency should first be carefully tested by well-planned experiments, which should only be undertaken on a large scale with a sufficient number of control animals and guided by a repeated examination of the blood.

The general indications to be followed in attempting to save diseased animals are perfect rest in a sheltered place. Sick animals should not be driven or excited, for the condition of the circulation is such that any effort may bring about rupture of blood-vessels and lead to speedy death. The heart, moreover, is always seriously involved, and should not be strained in any way. Again, the exposure of sick cattle in the sun's heat without shelter is liable to increase the already abnormally high temperature. We have, in fact, observed on unsheltered fields, during very hot days, a rise of from 2° to 3° F. in presumably healthy cattle during the day, which we must attribute to the effect of the sun's heat. A sheltered place, preferably in the open air, in which the sick animal remains free from the annoyances of other animals, is therefore best suited to its condition.

An abundance of pure water should be supplied to aid the overtaxed liver and kidneys in excreting their abnormal products in a more diluted condition. The food given should be readily digestible. It may be, on the whole, better to withhold food entirely, since the various digestive organs are in a congested state and not in a condition to do any work.

The disinfection of infected pastures is out of the question and must be left to nature in winter. They may, however, be used for sheep, since we have found these animals unharmed after grazing on them during an entire summer. It is highly probable that all other domesticated animals may run over such pastures with impunity, since Texas fever, outside of the bovine species, has not yet been observed.

CONCLUSIONS.

(1) Texas cattle fever is a disease of the blood, characterized by a destruction of red corpuscles. The symptoms are partly due to the anæmia produced, partly to the large amount of débris in the blood, which is excreted with difficulty and which causes derangement of the organs occupied with its removal.

(2) The destruction of the red corpuscles is due to a microörganism or micro-parasite which lives within them. It belongs to the protozoa and passes through several distinct phases in the blood.

(3) Cattle from the permanently infected territory, though otherwise healthy, carry the micro-parasite of Texas fever in their blood.

(4) Texas fever may be produced in susceptible cattle by the direct inoculation of blood containing the micro-parasite.

(5) Texas fever in nature is transmitted from cattle which come from the permanently infected territory to cattle outside of this territory by the cattle tick (*Boöphilus bovis*).

(6) The infection is carried by the progeny of the ticks, which mature on infected cattle, and is inoculated by them directly into the blood of susceptible cattle.

(7) Sick natives may be a source of infection (when ticks are present).

(8) Texas fever is more fatal to adult than to young cattle.

(9) Two mild attacks or one severe attack will probably prevent a subsequent fatal attack in every case.

(10) Sheep, rabbits, guinea-pigs, and pigeons are insusceptible to direct inoculation. (Other animals have not been tested.)

(11) In the diagnosis of Texas fever, especially in the living animal, the blood should always be examined microscopically, if possible.

TUBERCULOSIS IN CATTLE.

This disease occupies at the present time a very prominent place in the public mind, and rightly so, for it is identical with tuberculosis in man, of which vital statistics claim that it is responsible for the death of fully one-seventh of the human race. A general summary of the nature of this disease and its distribution among domesticated animals was presented in the report for 1889. The problem now before us, which has been advanced considerably by investigations over the whole world, is to determine the extent to which the milk of tuberculous cows is infected with the bacilli of this disease and the readiest means of detecting such infection. By examining the milk of presumably tuberculous cows at different stages of the disease we hope to gain some definite ideas as to the conditions under which milk must be regarded as positively dangerous. It is true that many sanitarians now regard the milk of tuberculous cattle in all stages of the disease as dangerous, and such a position is undoubtedly the safest. But until more stringent regulations are enforced concerning the regular inspection of dairy cows we must content ourselves with defining, if possible, the limits of danger. All authorities are, however, agreed that the milk of tuberculous cows suffering with tuberculosis of the udder or bag is positively dangerous, and from this point of view alone, if from none other, the careful inspection of dairy cows for any diseased condition of the udder becomes imperative. Our own investigations have shown that in cows in an advanced stage of tuberculosis the milk may contain tubercle bacilli, although the udder is free from any tubercular changes which can be detected by the naked eye at the autopsy.

Another problem depending on the former for its importance concerns the easiest and surest means of detecting tuberculosis in cattle. Koch's tuberculin seems to have largely bridged over the difficulty, and we shall, whenever opportunity presents, make test inoculations with tuberculin and endeavor to confirm by post-mortem examination the accuracy of the diagnosis. Preliminary trials have been sufficiently favorable to induce us to agree with former experimenters in regarding tuberculin as the best means at hand for the diagnosis of tuberculosis in cattle.

SPORADIC PNEUMONIA IN CATTLE.

During the winter of 1891–'92 the writer spent considerable time in the examination of various forms of pneumonia in cattle, from a bacteriological as well as pathological standpoint, to determine how far such forms of pneumonia could be distinguished from contagious pleuro-pneumonia, and what were the distinguishing characters. About twenty lungs or portions of lungs came under observation, among them a few of the last cases of pleuro-pneumonia. The importance of a thorough understanding of ordinary pneumonias is apparent now that contagious pleuro-pneumonia is a thing of the past in this country. The economic importance of being able to state definitely whether a given disease is contagious pleuro-pneumonia or not is second to none in comparative pathology. Such a differentiation is, however, only possible after a comprehensive investigation. More definite knowledge on this subject is particularly desirable in view of the vague ideas of European writers on this subject.

The presence of sporadic pneumonia in American cattle was determined by Nocard, in France, who described the lesions as similar to pleuro-pneumonia, but different in that they were associated with a certain bacterium. A culture of this bacterium was handed to me by Dr. Salmon, chief of the Bureau, last summer, and a careful examination proved it to be none other than the bacterium found by me for several years previous in cases of lung disease in cattle, and briefly referred to in the Report of the Secretary of Agriculture for 1889 (page 92). Nocard erroneously refers to this disease as the cornstalk disease, and also describes the bacterium as motile, although this is not the case.

To what extent certain kinds of bovine pneumonia are due to this bacterium, which, by the way, is not distinguishable from the swine-plague group of bacteria, we are not enabled to state positively at the present time. It is to be hoped, however, that the name cornstalk disease be given up when reference is made to bovine pneumonia, the causes of which may be a great variety of conditions, including the presence of certain disease germs.

THE CORNSTALK DISEASE OF CATTLE.

The investigation of this obscure malady has been taken up during the fall of the year. Dr. V. A. Moore was directed to study the disease in Iowa and adjoining States from a bacteriological and pathological standpoint, and Dr. F. L. Kilborne was associated with him to examine the external conditions under which the disease originates. The work is not advanced far enough for us to draw any definite inferences. We trust that when the material collected has been thoroughly studied some clue as to the nature of this disease may be forthcoming, so that another year may witness the complete elucidation of the causation of this widespread disease, and valuable suggestions as to its prevention in the future.

DISEASES OF HORSES IN THE WEST.

During September and October of this year E. C. Schröder, M. D. V., was directed to investigate two horse diseases in the West, the former the so-called bottom disease affecting horses along the bottom-lands of the Missouri River, in Iowa, South Dakota, and Nebraska, and the latter a peculiar affection among the range horses south of the North Platte River, in Wyoming.

Dr. Schröder gives the following brief report of his observations in the field:

> The bottom disease closely resembles Lupine poisoning in its clinical history and gross pathology. It has caused annual losses of greater or lesser consequence for more than thirty years, the losses during the present year reaching 1,800 horses of all ages at a low estimate. The affection commences early in spring and lasts throughout the summer and fall. Some horses die two or three days after showing the first symptoms, others live two or three weeks, and still others—and they are the most common—linger two or three months, during which they are perfectly useless.
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> Regarding the Wyoming disease, owing to the lateness of the time of investigation, little or nothing definite could be learned beyond the fact that it has caused losses of such magnitude during the last four or five years, previous to which it had not been observed, that the ranchmen fear a total destruction of the horse-raising industry in the southeastern portion of the State if some check is not speedily found. This disease makes its appearance towards the latter half of summer, about the time the vegetation loses its moisture, and continues until the beginning of October. Few cases recover; death usually follows the first symptoms in a few days.
>
> This disease, as well as the bottom disease, are well worthy of further attention on the part of the Bureau.

MISCELLANEOUS WORK.

In connection with these important subjects various other problems received more or less attention in the laboratory whenever time and opportunity were presented. Preventive inoculation, more particularly with reference to swine diseases, has been studied on the smaller experimental animals, and new methods tested. The successes which Prof. Metchnikoff, of the Pasteur Institute, claimed to have achieved in the preventive treatment of rabbits with reference to hog cholera have been tested in this laboratory. As far as they have been carried out, our experiments do not agree with his, as regards the results obtained. This discrepancy was cleared up by the careful study of a culture of the presumed hog-cholera bacillus kindly sent by Prof. Metchnikoff. The bacillus was not hog cholera, but swine plague. There has evidently been some misconception in the mind of this, as well as other European investigators, as to what the hog-cholera bacillus really is. Our own work, some years ago, clearly showed that rabbits are easily protected by the inoculation of sterilized cultures of the swine-plague germ, and made way for the belief that other methods would be equally successful; hence Metchnikoff has not presented anything unexpected, if we apply his results to the swine-plague group of bacteria.

In addition to this experimental work, the examination of diseased organs of various domesticated animals sent to the laboratory for diagnosis and suggestions as to prevention have taken up more or less time. Cases of actinomycosis, glanders, anthrax, rabies, and of various diseases of fowls have come under our observation.

INVESTIGATIONS CONDUCTED BY THE BIOCHEMIC LABORATORY DURING 1892.

By Dr. E. A. DE SCHWEINITZ.

MALLEIN.

During the year a great deal of the work in this laboratory has been directed to the preparation and study of mallein, and, in conjunction with Dr. Kilborne, to an examination of its practical value as a means of diagnosing latent glanders.

The French and German authorities, Nocard, Preusse, Tietze, and others, regard mallein as an invaluable aid in the examination of supposed glandered animals. The tests which have been made at the station of this Bureau, and, at our request, by a number of veterinarians in different parts of the United States, have given in all instances satisfactory results. By its use the latent disease has been detected in horses which, so far as every other means of diagnosis would indicate, appeared to be perfectly healthy. The autopsies have proved the correctness of the diagnosis with mallein.

The mallein, as prepared in this laboratory, is a glycerin extract from the cultures of the bacillus malleus. For practical purposes a glycerin bouillon is the most satisfactory culture medium for the growth of this germ, and it is from such cultures that all the mallein of this Bureau has been prepared.

As the biochemic laboratory is now ready to supply mallein to parties who are willing to give it a careful test and keep a record of their results, it should prove of great value to the veterinarians and horse-owners in the country, especially in those sections where glanders is prevalent. The detailed reports and tabulated results of the individual tests which have been made for us by Drs. Dinwiddie, Casewell, and Francis, and also at the station of this Bureau, have been already published in the American Veterinary Review, and a still more detailed report will appear in the annual report of this Bureau.

The directions which have been sent out with the mallein, to serve as a guide in testing it, are as follows: Make the test, if possible, with a healthy horse as well as with one or more affected with glanders.

Take the temperature of all these animals three times a day for one or two days before making the injection. On the day of making the injection take the temperature every two hours from early in the morning until late in the evening. Use for each horse one cubic centimeter of the solution as sent you, and make the injections beneath the skin of the shoulder with an ordinary hypodermic syringe. Be careful and thoroughly sterilize the syringe after injecting each horse, or better, use separate syringes for healthy and suspected animals. If the same syringe must be used, inject the healthy animals first and thoroughly sterilize after each of the other injections. Sterilize the thermometer in a solution of carbolic acid after taking the temperature of each horse. The temperature will begin to rise as a rule from three to four hours after the injection and reach its maximum eight to ten hours after the injection. On the two days succeeding the injection take the temperature three times a day. Note the general condition of the animal before and after the injection. After four or five days the injection should be repeated.

The solution of mallein should be kept always in a tightly-sealed bottle in a cool place. As prepared for shipment the mallein is diluted with an equal volume of glycerin—50 per cent—so that it will keep better.

A résumé of the results of the experiments which have so far been conducted is that the mallein has caused a rise in the temperature of all horses affected with glanders or farcy of from 3° to 5° F. In some rare cases the mallein will also cause a rise of temperature in healthy animals, but when the injection is repeated there is no rise. Coupled with the rise of temperature we have always noted in diseased animals a marked persistent swelling at the point of inoculation, increasing often on the day succeeding the injection, disappearing again four to five days afterwards. In the healthy animals this local swelling was either altogether absent or very slight, and had disappeared upon the day after the injection. In some instances the injections with mallein were repeated upon the same diseased animal a number of times. The reaction in temperature and swelling in these cases were always marked, while healthy animals, upon a second injection, showed no effect, and had apparently acquired an immunity.

The value of the mallein, however, as a means of diagnosis has been conclusively demonstrated, and, used under proper legal restrictions, would eventually result in the stamping out of this disease.

TUBERCULIN.

Just as mallein is a valuable diagnostic aid in glanders, so is tuberculin in the examination of suspected tuberculous cattle.

When we consider how this disease can be communicated to man from cattle by means of the milk or otherwise, how easily one diseased animal can infect an entire herd, the importance of a quick and sure means of early diagnosis is at once apparent.

Tuberculin, like mallein, is obtained from the products of the growth of the bacillus causing the disease, and when injected into diseased animals, causes a marked rise of temperature, while healthy animals are not affected.

With the view of preparing tuberculin for general use and studying its properties it seemed desirable to secure a culture medium as inexpensive as possible, and one which could be quickly made. Such a medium is obtained by adding to 1,000 c. c. of distilled water, 0.2 gram magnesium sulphate, 1 gram acid potassium phosphate, 10 grams ammonium phosphate, 70 c. c. of glycerin, and one gram peptone. The solution as first obtained in this way has an alkaline reaction, but can easily be made either neutral or even acid by simply boiling, as some of the ammonia is thus driven off. Upon this medium the tubercle bacillus multiplies well and rapidly.

In the preparation in the biochemic laboratory of considerable quantities of tuberculin we have used a neutral peptonized beef broth containing 7 per cent of glycerin, and its value has been satisfactorily tested upon tuberculous animals.

The experiments which have been conducted by the Bureau are confirmatory of those made abroad where Koch's lymph has been used. The injection causes no rise of temperature in healthy animals, while tuberculous animals show a rise of temperature of from 2° to 5° F. For purposes of comparison both Koch's tuberculin and that prepared here have been used upon the same animals, or in the same herd, with the production of almost identical results. Where the rise of temperature indicated diseased conditions of the animals they have been killed, and the autopsies proved the correctness of the diagnosis. In several instances, where the ordinary physical examination of the animal would have indicated perfect health, the post-mortem examination made in virtue of the reaction obtained from the lymph has demonstrated the presence of the insidious tubercle bacillus.

For better preservation our tuberculin is made up with an equal volume of glycerin, and in this solution it will retain its properties for some time.

The injections of the tuberculin are made in a similar way to those with mallein, but in no instance has any local swelling been noticed from the tuberculin, while in the use of the mallein upon glandered horses the local swelling was equally as characteristic as the rise of temperature.

In preparing tuberculin and mallein, great care and precautions have to be observed. The culture media must be properly prepared and the active principles extracted when the growth has advanced to a certain point, while the utmost care must be used to have the lymph free from germs without having in anyway destroyed the active principle.

The Bureau is therefore prepared to furnish the means for diagnosing two of the most widespread and dangerous diseases of domestic animals.

With the coöperation of the experiment stations and veterinarians of the country, these two diagnostic materials can be made of inestimable value.

DEHORNING COMPOUNDS.

Dr. Kilborne conducted some experiments during the year with three of the patent chemical dehorners found in the market, which we will designate as A, B, and C, with the results as given in the table:

No. of animal.	Age when applied.	Condition of horn.
A.		
	Days.	
76	42	Uninjured.
87	7	Do.
89	32	Do.
98	28	Killed.
B.		
77	45	Killed.
91	11	Do.
81	6	Do.
92	29	Do.
C.		
79	31	Uninjured.
86	11	Killed.
85	30	Uninjured.
99	26	Do.

These dehorners are chiefly a strong solution of caustic soda, and of the three, *B* dehorner seems to give the most satisfactory results. A dehorner was prepared in the laboratory and tried in comparison with *B*. It contained 50 per cent caustic soda + 25 per cent kerosene + 25 water. An emulsion of the kerosene and soda was prepared by heating and vigorous stirring and this was then dissolved in water. It was applied to the right horn of the calves, while dehorner *B* was applied to the left. Applied to the horns of a calf 23 days old both horns were dead in fourteen days, and have showed no signs of growth.

An ordinary solution in water of 50 per cent crude caustic soda stunted the horns, but did not kill them.

The kerosene emulsion appears equally as effective as dehorner *B*, and is of course considerably cheaper.

All these dehorners, however, to obtain the best results should be applied to the button before the animal is 30 days old.

These experiments are given, as they may prove of value to cattlemen. The dehorners, if carefully applied to the button and not allowed to come in contact with the adjacent skin, are practically painless to the animal.

REPORT UPON INVESTIGATIONS RELATING TO THE TREATMENT OF LUMPY-JAW, OR ACTINOMYCOSIS, IN CATTLE.

By Dr. D. E. Salmon, *Chief of the Bureau of Animal Industry*

REVIEW OF THE WORK.

Since 1889 the disease of cattle known scientifically as actinomycosis, and popularly as "lumpy-jaw," has attracted much attention in the United States on account of sensational publications alleging its great prevalence and dangerously contagious character. The Illinois board of live-stock commissioners appears to have been the first to accept this view and the most active in promulgating it. Since 1888 that board has seized and slaughtered a large number of animals, both at the Union Stock Yards at Chicago and at the National Stock Yards at East St. Louis. As there were included among the animals seized many in the best of condition and but slightly affected, and as these were turned over to parties for rendering purposes who allowed to the owners for a long time less than one-third of what the carcasses were worth even for that purpose, there was naturally much dissatisfaction created. It was claimed that, in addition to the unnecessary and unjust loss on affected animals which the owners were compelled to suffer, the inspection was not uniform; that many affected animals were not seized; that those badly affected were in some cases passed by the inspectors as fit for food, while in other cases those but slightly affected and in good condition were sent to the rendering tanks. More than this, the contagiousness of the disease among animals and the danger of its transmission to man, as well as the jurisdiction of the State board of live-stock commissioners in assuming the duty of meat inspectors, were seriously called in question.

The Bureau of Animal Industry was confronted with this condition of affairs when it began the inspection of meat at Chicago under the act of Congress approved March 3, 1891. The shippers of cattle at once made numerous complaints of the arbitrary, arrogant, and unjust manner in which the State board was acting, and, on the other hand, the board attempted to dictate to the Department as to what carcasses should be condemned by its inspectors and what passed as fit for food. It became necessary, therefore, that this Bureau should make an investigation as to the facts and take such action in its own work as would secure justice to the cattle owners, and at the same time protect the consumers of meat from any carcasses that were in the slightest degree dangerous to the public health.

The matter has been a difficult one to adjust because there existed, on the one hand, a board which has not hesitated to make the most sensational assertions, alarming to the consumers and damaging to the meat trade of the country, and on the other, a body of consumers exacting as to the quality of their food, sensitive to any aspersions upon it, and disposed to ask the destruction of meat though perfectly wholesome, if a breath of suspicion had been directed against it. This disposition of consumers, and the desirability of protecting the public health at any cost, no doubt accounts for the ability of the board to maintain its seizures for so long a time, though they were generally recognized as unjust, and suspected to be without legal authority.

In the spring of the year 1892 the attention of the Department was called to a remedy which appeared to have extraordinary effects in the treatment of this disease. An experiment was made on a single steer, which was badly affected, by Dr. Norgaard, an inspector of the Bureau of Animal Industry, and this steer was completely cured.

The following announcement was then made for the information of those interested in this subject:

> The interest which has been shown by the stockmen of the United States in regard to the disease known as "lumpy-jaw," or that form of actinomycosis which appears as external swellings on the head, renders it desirable that a preliminary statement should be made concerning the treatment of this disease. Until recently it has been the opinion of the veterinary profession that a cure could only be obtained by a surgical operation, and that this should be performed in the early stages of the disease in order to insure success.
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> In March last an important contribution to our knowledge of this subject was made by M. Nocard, of the Alfort Veterinary School, in a communication to the French Central Society of Veterinary Medicine. He showed clearly that the actinomycosis of the tongue, a disease which appears to be quite common in Germany and is there known as "wooden tongue," could be quickly and permanently cured by the administration of iodide of potassium. M. Nocard calls attention to the success of M. Thomassen, of Utrecht, who recommended this treatment as long ago as 1880, and who has since treated more than eighty cases, all of which have been cured. A French veterinarian, M. Godbille, has treated a number of cases with the same remedy, all of which have been cured. M. Nocard also gives details of a case which was cured by himself.
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> All of the cases referred to were actinomycosis of the tongue, and no one appears to have attempted the cure of actinomycosis of the jaw until this was undertaken by Dr. Norgaard, veterinary inspector of the Bureau of Animal Industry. He selected a young steer in April last, in fair condition, which had a tumor on the jaw measuring 15¼ inches in circumference, and from which a discharge had already been established. This animal was treated with iodide of potassium, and the result was a complete cure, as stated in the reports which were recently given to the press at the time the animal was slaughtered in Chicago. If lumpy-jaw can be cured so easily and cheaply as this experiment would lead one to suppose, the treatment will prove of great value to the cattle-raisers of the country. As is well known, there is a considerable number of steers weekly coming to our markets which are condemned because they are diseased to such an extent that the general condition of the animal is affected. If these could be cheaply and readily cured by the owners, it would prevent the loss of the carcass and solve all the troublesome questions which have been raised in regard to the condemnation of such animals.
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> The curability of the disease does not affect the principles which have been adopted in inspecting and condemning animals affected with it. This Department has never considered it necessary to condemn animals affected with actinomycosis on account of the contagiousness or the incurability of the disease. Such condemnations have been made when the disease was so far advanced as to affect the general condition of the animal, and all such carcasses would be condemned whether the disease from which the animal suffered was contagious or not, or whether it was curable or incurable.
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> The treatment with iodide of potassium consists in giving full doses of this medicine once or twice a day until improvement is noticed, when the dose may be reduced or given less frequently. The size of the dose should depend somewhat upon the weight of the animal. M. Thomassen gives 1½ drams of iodide of potassium daily in one dose dissolved in a pint of water until improvement is noticed, which, he states, is always within eight days. Then he decreases the dose to 1 dram. The animals do well under this treatment, showing only the ordinary symptons which follow the use of iodine, the principal ones being discharge from the nose, weeping of the eyes, and peeling off of the outer layer of the skin. These symptoms need cause no uneasiness, as they never result in any serious disturbance of the health.
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> M. Godbille has given as much as 4 drams (half an ounce) in one day to a steer,

decreasing the dose half a dram each day until the dose was 1½ drams, which was maintained until the twelfth day of treatment, when the steer appeared entirely cured.

M. Nocard gave, the first day, 1½ drams in one dose to a cow; the second and succeeding days a dose of 1 dram in the morning and evening, in each case before feeding. This treatment was continued for ten days, when the animal was cured.

Dr. Norgaard gave 2½ drams dissolved in water, once a day, for three days. He then omitted the medicine for a day or two, and continued it according to symptoms. These examples of the treatment as it has been successfully administered by others will serve as a sufficient indication for those who wish to test it.

Experiments are now being conducted on a large scale by the Bureau of Animal Industry in the treatment of lumpy-jaw with this remedy, and the results will be published as soon as possible. In the meantime it would be well for all who have animals affected with this disease to treat them according to this method, and report results to the U. S. Department of Agriculture, Washington, D. C.

Arrangements were made at as early a day as possible to test the remedy on a large scale with the affected animals as they came to the Union Stock Yards at Chicago. As the State board was still exercising its assumed power to seize, quarantine, and slaughter affected animals, they were requested to release from quarantine all such animals arriving during the time necessary to collect the number which was desired for the experiment, and allow them to be taken without interference to the stables where they were to be fed and treated. This they agreed to do.

No sooner, however, was an attempt made to collect affected animals for the experiment than it was reported by the inspector of the Department at Chicago that the State veterinarian was passing all these animals as fit for food except those in the very worst stages of the disease. This change in the policy of the State board made it difficult to obtain the necessary cattle for treatment, but some were collected, and these the board put in quarantine, so that they could not be taken out of the stock yards. This action made it necessary for the Secretary of Agriculture to call upon the governor of Illinois for his interference, which was done in the following telegram:

VIROQUA, WIS., *August 23.*

GOV. J. W. FIFER,
Springfield, Ill.:

Have received following telegram from Dr. Melvin, in charge of meat inspection at Chicago: "Stock Yards Company refuse to allow cattle to go out of yards on orders issued by you or myself. Baldridge will have carload by Wednesday. They will only recognize orders of the State." Will you please instruct your live-stock board to allow us to ship out all cattle for experiments in lumpy-jaw? I am anxious to have cattle in all stages of disease for experiment by Department's remedy. I am now two weeks behind in this work on account of not being able to procure cattle, and if I am to be subjected to further delay I will have to go to Kansas City to make experiments. Answer here.

J. M. RUSK,
Secretary of Agriculture.

To this request Governor Fifer replied in two telegrams, as follows:

SPRINGFIELD, ILL., *August 23.*

HON. J. M. RUSK, *Secretary of Agriculture,*
Viroqua, Wis.:

I have directed the Illinois live-stock commissioners to allow your agents to ship cattle diseased with lumpy-jaw for experiments by your Department, as requested by you.

JOSEPH W. FIFER.

SPRINGFIELD, ILL., *August 29.*

HON. J. M. RUSK, *Secretary of Agriculture,*
Viroqua, Wis.:

I am advised that the United States officials have full charge of the cattle in question, for the purpose of experiment, and are only held responsible for their safekeeping. The officials of this State are seeking to exercise no control over them beyond this. Is not this satisfactory?

JOSEPH W. FIFER.

After the governor's assistance had been secured, the animals purchased were allowed to leave the yards for treatment, and a better class was obtained, but the influence of the State veterinarian was still exerted to prevent the Department from collecting the milder cases. Although animals so affected had been freely condemned before, they were now said to be either free from the disease or perfectly fit for food. Under such circumstances the owners naturally preferred to sell their affected animals on the market included in the lots with which they had been shipped.

Notwithstanding the obstacles put in the way of the experiment, 180 animals, in various stages of the disease, were finally collected and put under treatment. No sooner had the first lots arrived at the stables than they were placed in quarantine by order of the Illinois board of live-stock commissioners. This hostile action was also laid before the governor by the Secretary of Agriculture, and on September 14 the quarantine was withdrawn by order of the governor. The following is the correspondence in the case:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., September 6, 189.

SIR: Allow me to thank you for your assistance in securing for me animals affected with actinomycosis for the purpose of experimenting with the same with a view to curing this disease.

As I telegraphed to you, your live-stock commissioners, immediately after I obtained these animals, placed upon them an order of quarantine, and I now write replying to your telegram asking whether said quarantine would in any way interfere with my experiments in this direction. I desire to call your attention in this connection to one or two facts. One of the purposes for which the Bureau of Animal Industry of the Department of Agriculture was organized was to investigate the diseases of domestic animals and to endeavor to ascertain the causes of the same and "means for the prevention and the cure" of animal diseases. At the same time the Bureau was, by its organic act, empowered to extirpate all contagious and communicable diseases among the domestic animals of the United States and to enforce all necessary measures to prevent their spread. These being some of the purposes for which the Bureau was organized, it would seem that when it undertakes to carry on an experiment with a view to discovering a cure for some certain disease, that all necessary measures to prevent any danger of the spread of such disease from animals being experimented on would be provided by the officers of the Bureau. For a State board, therefore, to place in quarantine animals being experimented upon by the Department of Agriculture is not only unnecessary, but has the appearance of being discourteous. It is a reflection upon the honesty and ability of the officers of the Department. It is not to-day believed by any competent person that actinomycosis, the disease with which the animals that are now being treated at Chicago are affected, is a contagious disease, or that there is any danger of its being communicated from one herd of cattle to another or to people. There is consequently no danger to be apprehended from the animals now in the possession of the Department at Chicago undergoing treatment. The great public benefit sought to be obtained by the experiment is such that it should not be interfered with or impeded by hostile acts of State officers. It would seem as if State authorities should coöperate in every way possible towards the successful accomplishment of such a purpose, and not, from jealousy or other cause, seek to prevent its success. The quarantine placed upon these animals, which the National Government has bought and paid for and which are now its property, is to me exceedingly irksome, and I consider it almost a personal insult; not only that, but, in my judgment, it is an illegal quarantine, so far as it applies to the work which is being carried on by the Department in the State of Illinois. The Department of Agriculture is operating in Illinois under the provisions of the act of Congress of May 29, 1884, and of the act of the State of Illinois of June 28, 1887, and under these acts it is beyond the control or interference of State officials.

I would further say that in conversation with Mr. C. P. Johnson, secretary of the board of live-stock commissioners of the State of Illinois, I was informed by him, in a very gentlemanly manner, that the reason of this quarantine was that there was some liability on the part of the State in case any disease should be spread from these animals. I have to assure you that there is no such liability, and whatever liability there might possibly be is assumed by the National Government, and that the law of Illinois above referred to expressly provides in section 3 that the State shall not be liable for damages, or expenses of any kind under the provisions of the same, and that this Department will hold itself responsible for any damages that may be inflicted by reason of the experiment which is now being carried on.

This experiment is being watched with a great deal of interest, not only by the stock-owners of the State of Illinois, but by the stock-owners of the entire United States, for, in case it proves successful, it will be of great benefit to all owners of cattle. I feel assured that I will have your best efforts to prevent any impediments being placed in my way in carrying the experiment to a successful end, and I would therefore request that you will kindly have the quarantine order made by the live-stock commissioners of your State at once rescinded.

Trusting that this request will meet with your approval, I am,

Very respectfully,

J. M. RUSK,
Secretary.

His Excellency JOSEPH W. FIFER,
Governor of the State of Illinois.

SPRINGFIELD, ILL., *September 14.*

Hon. J. M. RUSK,
Secretary Agricultural Department, Washington, D. C.:

The live-stock commissioners of this State will remove quarantine from the diseased cattle your Department is experimenting on in Chicago, as requested in your letter to me.

JOSEPH W. FIFER.

On November 29, 1892, eighty head of the cattle which had been under treatment were shipped to Chicago and slaughtered. There were two lots of 40 each. The first lot was supposed to be nearly or quite all cured, while the second lot was made up of the worst cases, many still having large swellings upon their heads, which were believed to be incurable. By direction of the Secretary of Agriculture, the following notice was mailed to the governor:

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Chicago, Ill., November 26, 1892.

DEAR SIR: I am directed by Hon. J. M. Rusk, Secretary of Agriculture, to inform you that a portion of the cattle which have been under treatment for actinomycosis or "lumpy-jaw" will be slaughtered at the slaughterhouse of Jacob Hess, Union Stock Yards, Chicago, on Tuesday, the 29th instant. The Secretary will be pleased to extend every facility for examination to any inspectors or others whom you may desire to have present on that occasion.

Very respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JOSEPH W. FIFER,
Governor of Illinois, Executive Mansion, Springfield, Ill.

There were present on the part of the State Mr. H. McChesney, of the Illinois board of live-stock commissioners; Mr. Johnson, the secretary of the board; Dr. Casewell, State veterinarian, and Drs. A. H. Baker and Joseph Hughes, assistant State veterinarians. There were also present on the part of the city, Mr. Pierce and an assistant. The inspectors representing the Bureau of Animal Industry who were present were Dr. A. D. Melvin, inspector in charge at Chicago, and Drs. Lewis R. Baker and Victor A. Norgaard, all being under the direction of the Chief of the Bureau of Animal Industry. Dr. Melvin was instructed to make the inspection carefully and condemn all carcasses about which there could be any doubt as to their fitness for human food.

When the slaughter began, the State veterinarian assumed to be in charge of the inspection; he put his assistants on the floor and with them examined the various organs of the animals, cutting them open, and in some cases removing them before they were seen by the inspectors of the Bureau, and even, in some instances, directing the removal of such organs by the workmen of the slaughterhouse before they had been seen by Dr. Melvin and without any consultation with the Chief of the Bureau, who was constantly present. Several times it was necessary to go to Mr. Hess, at whose slaughterhouse the animals were killed, and ask him to instruct his men not to remove the organs of any animals from the killing-floor or from places where they could be identified until Dr. Melvin had given his consent to such removal. A number of students of the Chicago Veterinary College, at which institution the two assistant State veterinarians mentioned are professors, had been brought there to witness the slaughter without the knowledge or consent of the Chief of the Bureau. A number of newspaper correspondents were also present, and, as they did not get their information of the killing from anyone connected with the Bureau, it is assumed that they were informed by some one connected with the State board. The result of so many persons being present who were unexpected was that the floor was crowded; the inspectors were obliged to work under difficulties, and it was only by exercising constant vigilance that the organs of the animals were examined before they were removed from the position where they could be identified with the carcass from which they came.

As long as these animals belonged to the Department of Agriculture and were being slaughtered under its direction, it certainly was no more than courtesy demanded that those in charge should have been consulted before information was given to so many persons not officially connected with the State, in order that it might be determined whether or not their presence would interfere with the proper performance of the work in hand. In addition to this, those present on the part of the State did not hesitate to speak disparagingly of the experiment, freely stating that they were condemning as large a proportion of these carcasses as were condemned from the "lumpy-jaw" cattle which come to the stockyards and are slaughtered without treatment.

At the close of the day's inspection the State veterinarian, without consulting with the Chief of the Bureau or with Dr. Melvin, and without informing the representatives of the Bureau what he had done, gave a certificate to the inspector present on the part of the city to the effect that 18 carcasses which had been passed by the inspectors of the Bureau of Animal Industry and tagged with the meat-inspection tag of this Department were affected with actinomycosis. As a result of this the Chief of the Bureau was notified by the city inspector that these carcasses could not be sold for consumption in the city of Chicago.

It should be stated that, during the whole day, in spite of the offensive action above mentioned on the part of those representing the State, these gentlemen were treated with every courtesy and given every facility for making their examinations, and no disagreeable word was spoken in their presence by any one representing this Department.

The inspectors of the Bureau of Animal Industry condemned every carcass in which a lesion was found which was of sufficient importance to justify the least suspicion that the carcass would be affected by it. None of the 18 carcasses passed by the United States inspectors and condemned on the certificate of the State veterinarian were affected in such a way as to cause any suspicion in the minds of any of the representatives of this Department as to the perfect wholesomeness of the carcasses. The lesions in all were very small, in one case not being larger than a grain of wheat, and in every case being insignificant. In a number of the cases these lesions, when examined microscopically, were found to be free from the actinomyces fungus, and, consequently, in these cases, there was an error of diagnosis on the part of the State veterinarian. I have been informed by Dr. Melvin that cases with much larger lesions than existed in any of the 18 cases mentioned have frequently been passed by the State veterinarian in his inspections at the stock yards and allowed to go on the market as fit for food. If the statement is correct, which was freely made, that no larger proportion of these carcasses were passed than were ordinarily passed among the lumpy-jaw animals which come to the stock yards, that of itself is sufficient evidence that the carcasses about which this unfortunate difference of opinion exists should have passed, because no animal without greater lesions than many of these had would have been held for examination.

From the statements made above it will be seen that the inspection made by the inspectors of this Department was entirely ignored, and that the State representatives, who were present by the courtesy of the Department and who have no responsibility as meat-inspectors, assumed authority to certify as diseased the carcasses of animals belonging to the Department which the Government inspectors declared to be entirely fit for food. Considering all these circumstances, and particularly that Government property was at stake which these gentlemen had shown their determination to cause to be destroyed by misrepresentation, I decided that it was no longer my duty, either on the grounds of courtesy or by any previous arrangement which had been made, to invite their presence when other animals belonging to the Government were to be slaughtered.

It may not be out of place to mention in this connection the fact, already referred to, that at the time these animals were being purchased the representatives of the State board apparently did everything in their power to prevent the collection of a sufficient number of animals for this experiment, and that, in order to accomplish this, affected animals, such as had previously been condemned, were freely passed as fit for human food.

I am free to state that the disease with which these animals were affected when they were purchased for experiment—that is to say, actinomycosis or "lumpy-jaw"—can not properly be considered as a contagious disease, requiring any such action to prevent its spread as is being taken by the Illinois board of live stock commissioners. If the disease is contagious at all, which is doubtful, it certainly is not contagious to the degree which requires measures to prevent its dissemination by animals in transit for slaughter. There is no satisfactory evidence that it can be disseminated by animals mingling with each other in cars or yards, and it is even doubted by recognized authorities if it can be transmitted by inoculation, on account of the many failures which have been recorded.

In the International Congress of Hygiene and Demography, held at London a year ago, there was unanimity of opinion to the effect that there was no danger of this disease being transmitted to persons who used the flesh of animals so affected for food, and, so far as I remember, I was the only member of that congress who sanctioned the condemnation of carcasses of animals affected with this disease, except when it was disseminated throughout the body; and my position was that this was only justified when the malady had made such progress as to have affected the general health of the animal, as shown by loss of flesh or by large suppurating abscesses. In no other country than the United States, so far as our information extends, are carcasses condemned as unfit for food when locally affected with the actinomyces fungus, provided the animal was in good health and in good condition of flesh when slaughtered. The action of the Illinois State live stock commission in deciding this to be a dangerously contagious disease and in forcing affected animals with even slight lesions to be destroyed as unfit for food is, in my opinion, unjustified as a measure to prevent the spread of disease and is a great wrong to the cattle-producers of this country. There is no doubt that many thousands of dollars' worth of property have been unjustly taken from the cattle-owners by such action. This would be the case, even if animals slightly affected were passed, as it is understood they have been in many cases. If, on the other hand, animals are to be condemned for the same reasons for which the eighteen carcasses above mentioned belonging to the Government were condemned, then a much greater number of animals would necessarily be sacrificed. If a great department of the National Government can not secure justice in the inspection of animals belonging to it, when it has the undoubted authority to make such inspection by its own inspectors, then the individual shipper certainly has a very small chance to secure justice in the handling of his product.

In conclusion, I would ask attention to the fact that the Union Stock Yards of Chicago is one of the channels of interstate commerce; that the cattle received there do not come from the State of Illinois alone, but from nearly every State of the Union; that this is not their final destination, but that many of the animals and most of the products are shipped from there to other States. From these reasons it would appear that the United States Department of Agriculture should have jurisdiction in such yards, both to prevent the spread of contagious diseases and to insure a just and uniform inspection of animals and meats.

The experience in the slaughter of the animals belonging to the Department, and the action taken by the State veterinarian, evidently under the direction of the board of live-stock commissioners, convinces me that there is much truth in the charges of arbitrary and inconsistent condemnation, and that something should be done by the United States Government to secure justice to the many cattle-owners in various parts of the country, who are under the necessity of shipping their cattle to the Union Stock Yards of Chicago for market.

Of the 80 cattle slaughtered on November 29, 43 were pronounced practically cured and fit for food by the inspectors of the Bureau of Animal Industry, and 25 were pronounced to be completely cured and fit for food by the State veterinarian. Considering that this number included 40 of the very worst cases taken for experiment, the result can not but be considered as extremely satisfactory. If the conclusions of the Bureau inspectors are taken, the result is a cure of 53 per cent of the affected animals; while should we accept the extraordinarily biased report of the State veterinarian, we still find that over 31 per cent of the animals were completely cured.

The following report given to the press by the State board explains itself:

NO CURES OF LUMPY-JAW EFFECTED.

REPORT OF STATE VETERINARIANS ON EXPERIMENTS MADE IN CHICAGO.

SPRINGFIELD, ILL., *December 7* (*special*).

The State board of live-stock commissioners to-day gave out for publication the following:

"CHICAGO, ILL., *December 5, 1892.*

"*To the State Board of Live-Stock Commissioners, Springfield, Ill.:*

"GENTLEMEN: Tuesday, the 29th of November, at the request of Mr. McChesney, of your board, we, the undersigned, assisted in making post-mortem examinations of 80 head of cattle that were slaughtered in Hess Brothers' slaughterhouse in this city. We beg to report on the same as follows: Fifty-five of these cattle were found to be affected with actinomycosis (lumpy-jaw) and 25 were healthy.

"Respectfully submitted.

"JOHN CASEWELL, M. R. C. V. S.,
"*State Veterinarian.*
"JOSEPH HUGHES, M. R. C. V. S.
"A. H. BAKER, D. V. S.,
"*Assistant State Veterinarian.*"

Forty of the cattle found diseased were, after fully two months' treatment, pronounced by the Bureau officials incurable; the other 40 were composed of the class of cases that the State veterinarian does not pronounce diseased on ante-mortem inspection, but holds for post-mortem inspection before deciding them affected with actinomycosis. After being treated for over two months, 15 of these 40 questionable cases were found, upon post-mortem examination, to be affected with actinomycosis. For months the percentage of this class of cattle pronounced free from disease, upon post-mortem examination each week by the State veterinarian, exceeds that of these 40 experiment cattle, so that so far as the experiment cattle already killed are concerned there is no evidence that the treatment used has effected any cures.

The statement that 40 of the cattle belonged to the "class of cases that the State veterinarian does not pronounce diseased on ante-mortem inspection, but holds for post-mortem inspection before deciding them affected with actinomycosis," is misleading, as there was not an animal among them that was not plainly affected with that disease when it was taken for treatment.

The other statement that "for months the percentage of this class of cattle pronounced free from disease upon post-mortem examination each week by the State veterinarian exceeds that of the 40 experiment cattle" is absolutely incorrect, unless it refers to the months during which the affected animals were being collected for this experiment. During these months it is freely admitted that the State veterinarian passed a large proportion of such cases as fit for food, even when they were badly diseased. This fact, admitted in the above press dispatch given out by the board, shows the insincerity and lack of principle governing their inspection. When they inspected the carcasses belonging to the Government they condemned every carcass which showed a tumor the size of a grain of wheat or an abscess the size of a hazelnut. When they inspected in the yards they passed cattle as sound which had tumors and abscesses larger than a man's clinched hand. In the latter case they were trying to prevent the Department from obtaining cattle for experiment, while in the former case they were trying to disparage the results of the treatment. Admitting, then, this statement of the board that "for months the percentage of this class of cattle pronounced free from disease upon post-mortem examination each week by the State veterinarian exceeds that of these 40 experiment cattle," it can be shown from their own reports that this has not always been the case. Of the 40 experiment cattle referred to, 25 were pronounced free from the disease by the State veterinarian; this is to say 62.5 per cent.

Referring to the reports of the board of live-stock commissioners for the State of Illinois for the years ending October 31, 1889, 1890, and 1891, we find the figures given for the number isolated and the number condemned as follows:

	Number isolated.	Number released.	Number affected and slaughtered.
1889.			
Union Stock Yards	840	58	782
National Stock Yards	123	3	120
1890.			
Union Stock Yards	1,563	144	1,419
National Stock Yards	100	5	95
1891.			
Union Stock Yards	2,259	133	2,126
National Stock Yards	131	6	125
Total	5,016	349	4,667

This table shows that for three years there was less than 7 per cent of the isolated animals which were pronounced free from the disease. To explain even this number, considered by the board to be large, the following statement is made in their report:

> The large number of animals released, as shown by the first table, is largely composed of those that were returned to the yards by the purchasers after they had reached the slaughterhouses, because they had a small lump, due to injuries or other causes than actinomycosis, fearing that this would be made an excuse by the city health inspectors in the slaughterhouse to cut down the carcasses, in which case the purchaser would have to bear the loss. All such cases turned back were inspected by our veterinarian, and we are advised that not a single one of these cases proved to be actinomycosis. (Annual Report of the Board of Live Stock Commissioners for the State of Illinois, 1890, p. 52.)

If, during the years 1889, 1890, and 1891, the State veterinarian was so expert in determining actinomycosis in the living animal that less than 7 per cent of those isolated were found free from disease, and even these were mostly animals with small lumps due to injuries, turned back by purchasers and not by the veterinarian, how can we explain the sudden loss of this expertness in 1892 and the isolation of over 60 per cent of cattle which are afterwards pronounced free from the disease? This question is a pressing one at this time, for the statements of the board are inexplicable and inconsistent, and it is plain either that these statements are incorrect or that there has been an extraordinary change in the principles governing the inspection.

The animals taken for the experiment of the Department did not include any turned back by the purchasers on account of injuries, but every one was pronounced by the veterinary inspectors to be affected with actinomycosis. How, under such circumstances, the board can state that they have for months pronounced over 62 per cent of such cases to be free from the disease is a mystery and shows conclusively that their action either in 1889, 1890, and 1891, or in 1892 was unskillful and lacking in uniformity, or that they purposely modified their principles of inspection in order to disparage the results of this experiment. Whatever may be the final conclusion as to the cause of their action, the open hostility of the board has been apparent from the time the first animals were selected, and it has continued with increasing intensity as the success of the treatment became more and more apparent.

As the officiousness of the State inspectors made a proper inspection by the Bureau inspectors a difficult matter, and as the former assumed jurisdiction as meat inspectors which is not given them by law, and as finally they had shown a determination to cause the destruction of carcasses of cattle belonging to the Government, which carcasses were not diseased, I decided not to invite them to be present when the next lot of cattle were slaughtered.

On December 2 a lot of 20 head, all of which had been cured, were slaughtered, at the same place, in presence of the Bureau inspectors above named, and also of the inspector of the city department of health. Every one of these animals was free from disease, as was shown by the most careful post-mortem examination.

The examination of the 100 head of cattle first slaughtered shows, according to the reports of the Bureau inspectors, who were unbiased and had no interest in the experiment beyond a desire to get accurate results, that sixty-three of these animals had been cured by the treatment. This is a cure of nearly two-thirds of the animals treated, and certainly can not be surpassed by the results of treatment with any of the internal diseases of a progressive nature which affect animal life. This is the more gratifying as some of the animals which were pronounced healthy by the State veterinarian had been affected with enormous tumors, which entirely disappeared during the course of the treatment.

The following correspondence in regard to the slaughter of 20 animals without notifying the State board explains itself:

STATE OF ILLINOIS, EXECUTIVE OFFICE,
Springfield, December 3, 1892.

DEAR SIR: Complaint is made to me by the live-stock commissioners of Illinois that on yesterday the second consignment of cattle delivered to your agent for experiment were slaughtered in Chicago without notice to the live-stock commissioners of this State. I am also informed that there was an agreement previously entered into, when these cattle were taken for experimental purposes, that the live-stock commissioners would be notified when said cattle were slaughtered, and afforded an opportunity to make a post-mortem inspection.

Permit me to call your attention to this complaint, believing that you will direct your agents in Chicago to carry out the agreement above named, and that, before slaughtering the remaining cattle under experiment, the commissioners will be duly notified and given an opportunity to make an inspection.

Yours, very truly,

JOSEPH W. FIFER.

Hon. J. M. RUSK,
Secretary of Agriculture, Washington, D. C.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 6, 1892.

DEAR SIR: I am in receipt of your favor of the 3d instant, in which you state that complaint is made to you by the live-stock commissioners of Illinois that on December 2 the second consignment of cattle from the animals under experiment by this Department was slaughtered in Chicago without notice to such commissioners.

In reply I would say that this is correct, and that, in order to give you a full statement of the reasons for such action, I inclose with this, for your information, a copy of the report made to me by Dr. D. E. Salmon, chief of the Bureau of Animal Industry, under whose direction the slaughter was made.

It appears from this report that the State veterinarian attempted to take charge of the inspection of the animals, that the inspection made by the inspectors of this Department was ignored, and that a certificate was given to the inspectors of the city department of health that eighteen carcasses were unfit for food which had been passed by the United States inspectors.

The invitation was extended to you by my direction, according to agreement, as an act of courtesy, to enable your representatives to witness the results of the experiment as revealed by the post-mortem examination, and every facility was given them for this purpose. Being there by invitation, their attempt to assume control and to enforce their unjust decision as to the disposition of the meat was an interference with the jurisdiction of this Department which could not be tolerated.

The Department inspectors were acting under the acts of Congress authorizing the inspection of meats, as well as the investigation and prevention of disease, and the test which they were conducting was to discover a cure in the interest of the cattle-raisers of the whole country. I am, therefore, surprised to learn that the live-stock commissioners of Illinois and their assistants have gone, not only to the full extent of their authority, but beyond such authority, to obstruct and delay this experiment and to disparage its results.

I regret that the action of the commissioners, or those acting for them on the day mentioned, was such as to lead Dr. Salmon to the conclusion that he could not conscientiously invite them to be present at the slaughter on Friday, the 2d instant.

I think you will agree with me that if his statement of facts is correct, and I have no doubt it is as he understood them, that he could not properly have done otherwise.

The stand which is taken by the live-stock commissioners of Illinois in regard to the condemnation of these carcasses is a matter of great consequence to the stock owners of the United States, and it also involves property belonging to the United States Government. The inspection of animals for food should be uniform and just, and the meat inspection of this Department, which is authorized by act of Congress, and which is carried on by competent men, should be recognized. As the responsible officer in charge, I can not permit it to be ignored or called in question by State officials who are not even given jurisdiction as meat inspectors by the laws of the State.

Very respectfully,

J. M. RUSK,
Secretary.

Hon. JOSEPH W. FIFER,
Governor of Illinois, Executive Mansion Springfield, Ill.

Soon after this the chairman of the Illinois board of live-stock commissioners addressed a communication to the Secretary of Agriculture, which was of so scurrilous and discourteous a character that it was returned to Gov. Fifer with the following letter:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 19, 1892.

SIR: I inclose herewith a communication addressed to me by the chairman of the Illinois State board of live-stock commissioners, which not only refers to a number of matters with which he has nothing to do officially, but which is so discourteous in its tone that I must decline to receive it. If the board mentioned has anything to bring to the attention of this Department which you deem proper to transmit, I shall be glad to give it careful consideration, but I can not have any direct communication with a man in that position whose ideas of official courtesy are exemplified by such a letter as the one I return.

The letter in question is incontestable evidence of Mr. McChesney's unfitness for the office which he holds.

Very respectfully,

J. M. RUSK,
Secretary.

Hon. JOSEPH W. FIFER,
Governor of Illinois, Executive Mansion, Springfield, Ill.

To this the governor replied as follows:

STATE OF ILLINOIS, EXECUTIVE OFFICE,
Springfield, January 3, 1893.

MY DEAR SIR: I am in receipt of your favor of December 19, and contents noted. When I received your letter of December 6 I immediately called upon the board of live-stock commissioners of this State for a full and complete statement concerning their action in the matter of diseased cattle turned over to your Department for experimenting in the city of Chicago, and I inclose you a copy of their report to me on that subject, dated December 16.

I regret exceedingly the conflict that has arisen. I had no knowledge whatever, directly or indirectly, that Mr. McChesney would write you as he did under date of December 16, and I regret exceedingly that he did so. My administration closes now in a few days. The general assembly of this State convened to-day. I am very busy with official business that must be closed out before I give up the office to my successor. Were it not that my term of office expires in a few days I would give this controversy between the live-stock commissioners and your representatives further consideration.

Assuring you of my high regard and esteem, I remain, yours very respectfully.

JOSEPH W. FIFER.

Hon. J. M. RUSK,
Secretary of Agriculture, Washington, D. C.

The Secretary of Agriculture replied to the above letter and asked for the removal of the quarantine which the board had again imposed upon the cattle. His letter is given below:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 7, 1893.

MY DEAR SIR: I am in receipt of your very satisfactory letter of the 3d instant, for which I wish to express my thanks. The report of the board of live-stock commissioners, which you state was inclosed, has not reached me, and for that reason I do not know what position they have taken in regard to the cattle belonging to this Department.

The chairman of the board, after writing his very discourteous letter to me, had the quarantine again put upon the cattle. I feel sure that you were not informed of this, or you would have taken action to cause its revocation. Up to the present it has caused me no embarrassment, because I was not ready to slaughter the cattle, but I wish now to have them slaughtered at once. I would request you, therefore, to have this quarantine removed, so that the cattle can be shipped to Chicago for slaughter the first of next week.

I am sure that you have been desirous of giving every facility for making this experiment, which is of so much interest and value to the farmers of your State and of the whole country, and that you are willing to do everything in your power to prevent delay in completing it, and giving the results to the cattle-owners, to whom it is of vital importance.

There was no reason whatever for the board of live-stock commissioners to put a quarantine upon these cattle, because they knew very well that I would ship them to Chicago and have them slaughtered. Cattle affected with actinomycosis are daily allowed to be shipped to the Union Stock Yards for slaughter, and, therefore, in case any of these are still affected, this Department is asking nothing beyond what is allowed without restriction to every cattle-owner in the country.

I hope that the board of live-stock commissioners will no longer be allowed to maintain their position for the purpose of obstructing an investigation made as much in the interest of the people of your State as for the people of any other section of the country.

Assuring you of my appreciation of your courtesy in this matter, I am, very respectfully,

J. M. RUSK,
Secretary.

Hon. JOSEPH W. FIFER,
Governor of Illinois, Springfield, Ill.

INJUSTICE TO OWNERS OF LUMPY-JAW CATTLE.

Although the Illinois board of live-stock commissioners began quarantining and condemning cattle affected with actinomycosis in 1888, it was not until their meeting of February 21, 1890, that they discovered that the owners of such cattle were only receiving from $2.50 to $4 per head for them. This was less than the value of their hides. Even at that late date the board did not make the discovery itself, but the facts were presented to it by a committee of the Live-Stock Exchange.

It is usually admitted that when the property of citizens is taken and destroyed for the good of the community the citizen who suffers the loss should receive a just compensation, and the law of Illinois under which the board has acted provides for the appraisement and compensation for cattle destroyed to prevent the spread of disease. Although the cattle affected with actinomycosis were ostensibly condemned to prevent the spread of that disease, it appears that no appraisement or compensation has been made as provided in the law. On the contrary, the destruction of these animals was enforced without any compensation from the State, and with no effort on the part of the board to see that the owners received even a just compensation from the parties who took possession of the carcasses. The owners were powerless. The cattle were seized and destroyed by order of the State board, and the carcasses were turned over to the Union Rendering Company, which gave for them what it saw fit, and no more. The result was the owners were robbed of two-thirds or three-fourths of the value of their cattle even for rendering purposes.

According to the inspection rules of every country which carries on a meat inspection, and also according to the teachings of the most eminent scientists who have investigated the question, actinomycosis is generally considered a local affection, and in its early stages does not affect the general health of the animal or the wholesomeness of the meat. There is no good reason, consequently, for condemning animals in good condition which present only a small swelling on the jaw caused by the actinomyces fungus, and from which there is no discharge. In this case the part of the animal involved is not used for food, and when that is removed it is the general opinion of scientists that the remainder of the carcass is not affected. To condemn and destroy such carcasses as this is, therefore, unjustifiable from any point of view. It is especially uncalled for as an act to prevent the spread of the disease, as the most extreme believers in the contagion theory can not explain how the disease could be transmitted from an animal which had no discharge from the tumor by which the fungus could be disseminated.

It has not been uncommon to see steers in fine condition, weighing from 1,600 to 1,800 pounds, and worth 5 cents a pound, condemned because of a small swelling on the jaw which was scarcely more than visible. Such a steer would bring on the market for beef $80 or $90, but when condemned and delivered to the Union Rendering Company the owner received, according to the board's own statement, not to exceed $4. And this wholesale appropriation of the farmers' property was allowed to proceed for nearly two years before the members of the board became officially aware of what an outrage they were assisting to perpetrate.

Since that time a more satisfactory arrangement has been made through the exertions of the Live-Stock Exchange. Under the new plan the carcasses are turned over to a rendering establishment in the stock yards, and the owner receives 1 cent a pound, less $3 a head. That is to say, the owner of a steer weighing 1,600 pounds would now receive $13 for the carcass. Even this is less than its real value for rendering purposes. In disposing of the cattle purchased by the Department for the experiment no difficulty was found in getting offers of 1 cent a pound without any discount. An offer of this kind was received from the very firm which obtains the other cattle condemned at $3 per head less. The conclusion is unavoidable, therefore, that the shippers of these cattle do not receive as much by $3 a head as they are entitled to and as the carcasses are really worth.

If we should admit, which we do not, that the condemnation of the board is in all cases legal and justifiable, there would still remain this great wrong of forcing the owners of these cattle to take $3 per head less than they are actually worth when sold with an opportunity for free competition in the purchase. One would suppose that a board assuming the authority and the responsibility of making such seizures would feel it incumbent upon itself to see that the owners were fairly treated in the disposal of their property, but apparently this is not the case.

THE JURISDICTION OF THE ILLINOIS BOARD OF LIVE-STOCK COMMISSIONERS OVER ANIMALS AFFECTED WITH LUMPY-JAW.

The Illinois board of live-stock commissioners is given no authority or duties by law in the inspection of meat. It was created to suppress and prevent the spread of contagious diseases among animals in the State of Illinois. Its powers to quarantine and cause the slaughter of animals is expressly limited by the statute under which it acts to animals affected with "dangerously contagious or dangerously infectious disease." Lumpy-jaw is, in the opinion of the State veterinarian, a dangerously contagious disease, and consequently the board assumes that it is fully empowered to quarantine and cause the destruction of animals so affected.

As many of the carcasses destroyed were plainly unfit for human food, being emaciated and in some cases affected with a more or less generalized form of the disease, there were many who were inclined to sustain the action of the board on this account, even if it should be shown that the disease was not "dangerously contagious," and consequently not within the intent of the law. However, the board did not confine itself to such carcasses, but seized animals in good condition, with only small lumps which were not discharging, and in general their actions were so arbitrary, dictatorial, and burdensome that the cattle-owners of a large section of the country tributary to Chicago have been loud in their protests and vigorous in their demands for relief.

This situation raises the question as to whether the board has, under the Illinois law, any jurisdiction over animals affected with this disease; in other words, whether actinomycosis is a dangerously contagious disease, as stated in the opinion of the State veterinarian. To sustain itself the board has collected a number of reports of experiments, in which it is alleged that the disease was communicated by inoculation with the tissue and discharge from the diseased parts of affected animals.

The reasoning appears to be that if a disease is inoculable it must be contagious, and if it tends to progress until the life of the animal is destroyed it must be dangerously contagious (Report, 1890, p. 20). This reasoning may be satisfactory to the board, but it will hardly be considered so by any unbiased scientist.

In the first place, a disease is not necessarily contagious because it is inoculable. Pyæmia, septicæmia, malignant œdema, black quarter, and tetanus (lockjaw) are all inoculable diseases, much more so than is actinomycosis, and yet it is well known that these diseases do not spread by contagion from animal to animal, and they cannot properly be regarded as contagious diseases. All of these diseases, with one exception, affect mankind, but it would be absurd to claim that people are infected from diseased animals because of the coincidence that man and animals both suffer from the germs of these diseases. It is well known that these germs exist nearly everywhere and that animals and men get them from the same source in nature. The actinomyces fungus is also widely distributed, and grows upon the straw and beards of grain, and probably upon grasses, and for that reason it must be almost universally present. Leading scientists have, therefore, concluded that, with this disease, as with lockjaw, the germs of the disease are obtained by man from the same sources as by animals—that is, from the sources in nature where they abound.

The next question which suggests itself is, what is meant by "a dangerously contagious or dangerously infectious disease?" The word "dangerously" is evidently an adverb qualifying the words "contagious" and "infectious," and, as all words in a statute are supposed to have been put there for a definite purpose, we can only conclude that not all contagious and infectious diseases are meant, but only the dangerously contagious and dangerously infectious diseases, as stated. The meaning of "dangerously contagious" or "dangerously infectious" in this connection can only be taken as highly contagious or highly infectious, or at least having such a degree of contagiousness or infectiousness as to make the affected animals dangerous to the stock interests of the State.

The board says, however, that "no one will claim that actinomycosis is a highly contagious disease" (Report 1890, p. 20). They go on to say that "when the actinomyces have invaded the vital organs of the body, the disease, in both man and animals, is pronounced, by physicians and veterinarians, as fatal as tuberculosis, hence it must be listed in the catalogue of dangerously contagious diseases."

This reasoning would make the word "dangerously," which is an adverb, qualify the word "disease," which is a noun. That is, it is assumed because this disease is dangerous and fatal, when not properly treated, that it is a "dangerously contagious disease." But adverbs do not qualify nouns, and hence the word "dangerously" can only refer to the degree of contagiousness or infectiousness, and not to the fatal character of the malady. A disease may be extremely fatal, but not in the least degree contagious, and it may be very fatal and only contagious when purposely inoculated, as in the case of tetanus, or lockjaw, but it would be perverting the use of language to speak of either of these classes of disease as "dangerously contagious."

It has been quite generally held by scientists who have investigated actinomycosis that it should be classed with those diseases which, like tetanus, or lockjaw, are produced by vegetable parasites inoculated by hard bodies of various kinds which are infected, and which accidentally wound the skin, the mucous membrane, or other tissues, and thus gain entrance to the body.

There have been a number of cases recorded in which actinomycosis has been experimentally transmitted by inoculation from diseased to healthy animals. A large proportion of the successful inoculations were made with rabbits and guinea-pigs—animals which are very susceptible to most kinds of infection. In some cases large animals have been used, and with these the disease has been sometimes transmitted, and in other cases no result has followed the inoculation. The methods employed have been to deposit infectious matter in the abdominal cavity or in the connective tissue, or to inject it directly into the blood vessels. The results in most of the cases are of theoretical rather than practical value, because it is not likely that animals would be accidentally inoculated into the abdominal cavity or into the blood vessels. It is also an admitted fact with other diseases that those which require wounds of the skin and mucous membrane for the parasites to gain entrance to the tissues only in exceptional instances spread from animal to animal under natural conditions. So with actinomycosis, it is theoretically possible, but not probable, that an accidental inoculation might occur by which the disease would be transmitted from a diseased to a healthy animal. This contingency is too remote, however, according to our present knowledge, to give any warrant for considering the disease as dangerously contagious.

The Illinois board of live-stock commissioners admits that before suppuration sets in, and there is a discharge, the disease is probably not transmissible, naturally, from one animal to another. (Rep. 1890, p. 20.) This conclusion is incontestable, but in spite of it many animals, which did not have a discharge, have been seized by order of the board, taken from the owners and condemned to the rendering tanks. How the board can justify such action under a law which only permits it to quarantine and slaughter animals affected with a "dangerously contagious" or "dangerously infectious" disease, it is difficult to understand.

If this board actually believes that actinomycosis is a dangerously contagious disease, its action has not been consistent with that opinion. Affected animals have been allowed to come freely into the Union Stock Yards to the number of 100 or 200 a month. They go into all of the pens, mix with thousands of cattle, and the action of the board, instead of hastening their slaughter, actually delays it and gives additional opportunity for contagion.

The diseased animals, instead of being slaughtered as soon as discovered, are placed in open pens, surrounded on all sides by healthy cattle, and are held in that condition until the end of the week, when the State veterinarian comes and decides as to whether they shall be condemned or not. There is no effort to clean and disinfect the pens where the diseased animals have been, and I have myself seen the State veterinarian open abscesses of affected animals and allow them to drip pus by the pint into the public alleyways of the yards, where thousands of cattle were driven, without any thought of having this infectious material cleaned up or disinfected.

Instead of lessening the chances of infection in the Union stock yards, the action of the State board actually increases it. Indeed, it is difficult to see how anyone believing in the contagiousness of the disease would cause the affected animals to be held in the interior of such great stock yards from the beginning to the end of the week before they are disposed of, and equally difficult to understand how constant and thorough disinfection could be dispensed with. It is impossible to find any measures adopted by the board which are calculated to prevent the spread of the disease, should it be contagious; but, on the contrary, the measures enforced, as already stated, are of such a nature as to assist the dissemination of contagion.

The board has devoted considerable space in its reports to arguments by which it attempts to show the danger to consumers of the meat of animals affected with actinomycosis. Their extravagant statements have excited the wonder and ridicule of sanitarians the world over. It would appear from the attention which the board has given to this aspect of the question, from the condemnations by it of some carcasses of affected animals and the passing of others as fit for food, from the neglect to disinfect cars, yards, and alleys where diseased cattle have been, and from the holding of diseased cattle in the stock yards a whole week for the visit of the State veterinarian, that its action in regard to lumpy-jaw is a meat-inspection measure and not a measure for the purpose of preventing the spread of a contagious disease among animals.

The board, however, has no authority to inspect meat, but was created for the purpose of "the suppression and prevention of the spread of contagious and infectious diseases among domestic animals." When it goes beyond this purpose it would appear to be acting outside of the law, and it certainly causes a great and unnecessary hardship to cattle owners in holding their animals a whole week for inspection. If there is to be a State meat inspection applied to cattle in the interstate trade, that inspection should be promptly made by competent inspectors, and there should be an end to this ridiculous method by which suspicious cattle are collected for a whole week by employés ignorant of the nature of cattle diseases, and then passed upon by the State veterinarian by a cursory examination on Saturday. An inspection of value to the consumers or satisfactory to the producers can not be conducted in yards where from 50,000 to 75,000 head of cattle arrive weekly, by a single veterinarian, who devotes but one day in the week to this duty.

The important question in this connection is as to whether the board has jurisdiction for the inspection of meat. If it has not, then its acts in condemning animals and meats for the purpose of preventing certain carcasses from going on the market for food can only be considered as illegal. In that case there would be no need of considering whether or not actinomycosis might be communicated to the consumers of the flesh of affected animals, as the question at issue would turn on the jurisdiction of the board, and the cattle owners would thus secure relief.

The danger of the transmission of this disease to people from affected animals has been insisted upon by the board in such unequivocal terms, however, that a public interest has been aroused which makes it desirable to quote the opinions of some of those unbiased scientists who have given most attention to the subject. Actinomycosis in people is a very rare disease, and but few cases are on record as having occurred in this country. If there were any great danger of its being communicated by the flesh of affected animals we should certainly expect that it would be more frequent.

Prof. Crookshank, in the course of an exhaustive review of our knowledge of actinomycosis, published in the annual report of the agricultural department, privy council office, on the contagious diseases, inspection, and transit of animals for the year 1888, says by way of conclusion:

> The successful transmission of actinomycosis from man to bovines suggests intercommunicability, but the negative evidence as to infection of man from bovines supports the view that the disease is derived from some source which is common to both species. (S. C., p. 115.)

In summing up the evidence as to the source of the disease in man he says:

> Many interesting observations have been made upon the origin of this disease in man. Two cases have been recorded in support of the theory of direct infection from the cow. Stelzner described a case of the actinomycosis in a man who had had the care of animals some of which had suppurating glands. Hacker had a case of the tongue in a man who had charge of cows, one of which had a tumor of the jaw, which he had opened. On the other hand, Moosbrugger found that out of 75 cases 54 were in men and 21 in women, including 2 children. In 11 of these the occupation was not stated. In 33 their occupation did not bring them into contact with diseased animals. They were, for example, millers, glaziers, tailors, shop people, and students. Only 10 cases occurred among farmers, peasants, and farm laborers. In 1 case only out of the 10 had the patient been in contact with diseased animals.
>
> Out of the 21 women there were only 4 peasants, and none of them had been associated with diseased cattle.
>
> Infection by the flesh of diseased animals has also been discussed, but there is no evidence of the prevalence of the disease among slaughterers and butchers, who

would be particularly liable to it if flesh were a source of infection. The chances of infection by ingestion are minimized by the flesh being almost always cooked. Actinomycosis occurs also in pigs, and pork is often eaten in an uncooked state, but Israël has pointed out that this may probably be excluded, as many of the cases occurred among strict Jews.

The evidence points to the disease originating in man and lower animals from the same source, and there is a very strong suspicion attached to cereals. This view is supported by important observations with reference to the part played by cereals in inducing the disease in cattle, which have already been mentioned, and it gains additional support from a case described by Soltmann, where the disease resulted from swallowing an awn of barley. A boy, aged 11, accidentally swallowed an awn of *Hordeum murinum*. He became very ill and suffered great pain behind the sternum extending over six intercostal spaces, and when opened the awn of barley was found in the evacuated pus. The pain, however, continued and fresh deposits occurred, and when the boy was taken to the hospital the ray-fungus was detected. Possibly the spores of the fungus can be conveyed both by air and water.

Friedberger and Fröhner, in the last edition of their excellent "Treatise on the Special Pathology and Therapeutics of the Domesticated Animals," published in 1892, give the following unbiased opinions, which they form from the scientific investigations made up to the present time:

Experiments to transfer the same to other animals have been made by several parties, but were always unsuccessful (Rivolta, Bollinger, Seidamgrotzky, Perroncito, Johne, Ullmann, Bodemer, Boström). Cattle, calves, goats, sheep, wethers, hogs, dogs, cats, rabbits, guinea-pigs, did not suffer after inoculation; only in some cases a granulation, outlined by inflammation, developed as the reaction of the organism against the inoculated foreign bodies. The alleged positive results of inoculation of Ponfik, Israël, Rotter, and Hanau refer, according to Boström, only to inoculation material which remained and was encysted (encapsuled). It appears that the actinomyces fungus produces a pathogenic effect only in that stage of development reached in connection with the beards of grain; but when once introduced into the animal body it is no longer transferable, because it immediately assumes involution forms (calcification) after inoculation. The negative results of the inoculation experiments are of great importance for the solution of the question whether or not a transmission of actinomycosis occurs from animal to animal or from animal to man. All are of the opinion that an infection of this kind does not take place (p. 585).

Inspection of meat.—As already mentioned in the article on "Pathogenesis," it must be considered as very improbable that the actinomycosis is a contagious or an infections disease in the sense of its transmission from animal to animal or from animal to man. A case of infection of man from cattle affected with actinomycosis has never been observed which was free from all objections. At the most, such a transmission may be considered perhaps as possible from a theoretical standpoint, but not as probable. Experience is positive against the occurrence of a direct transmission. The actinomycosis, therefore, in relation to the inspection of meat is by no means so important as tuberculosis, even setting aside the fact that the former usually represents only a local affection. The meat of cattle affected with actinomycosis may be commercially disposed of without hesitation after the affected parts have been removed; it is objected to only in the rare cases of a generalized actinomycosis (p. 592).

Ostertag, in his "Handbook of Meat Inspection," published in 1892, says, after reviewing the evidence at hand:

According to this, we are hardly justified in assuming that the use of actinomycotic organs as food is injurious to health. At any rate, we must deny the possibility of this for the meat of actinomycotic animals. The activity of the sanitary police should therefore be restricted to the detection of all organs affected with actinomycosis, and the withdrawal of them from the market as highly spoiled food products in proportion as the specifically changed portions can not be certainly removed. In isolated lesions in the tongue this will usually be possible, and is further recommended, as the tongue is a valuable organ. In cases of generalization the whole animal is to be withdrawn from the market, because the generalization in actinomycosis seems to have an entirely atypical cause, and the detection of the total lesions (in the bone, in the depth of the muscles) is much less easy than in tuberculosis, in which the regular lymph gland affection answers as an excellent guide for the discovery of the diseased areas.

Prof. Thomas Walley, in the second edition of his very thorough "Practical Guide to Meat Inspection," published in 1891, says (pp. 135–387):

> The malady affects man, and is in him known as *actinomycosis hominis*, and while it has been transmitted by inoculation from man to the calf (Crookshank), so far as I am aware there is no direct evidence of the transmission of the disease from animals to man. Nor indeed is such a contingency ever likely to arise, seeing that the vitality of the spores of the hyphomycetes is much inferior to those of the pathogenetic fungi, and that the changes produced by it in the organs attacked are so marked as to attract the immediate attention of even ordinary persons; and what is of more importance, the lesions of the disease are seldom localized, except in the pig, in the muscular tissue of the body. * * * Although certain organs, such as the tongue, may be largely involved, there is not much accompanying fever or interference with the normal functions or with the nutrition of the blood, and any systemic changes that arise are due mainly to annihilation of the functions of the tongue, or of the particular organ involved, and as a result of this a state of poverty is induced. Seeing that the disease is rarely of a systemic nature, and that there is an absence of fever, the nutritive changes induced in the muscles are so slight as to do away, in the great majority of cases, with the question of nocuity of the flesh; but, notwithstanding this, if there is any evidence of malnutrition of the blood or of the flesh, the carcass should be condemned for human food and in every instance the affected organ or organs should be effectually destroyed.

EXPERIMENT TO TEST THE CONTAGIOUSNESS OF ACTINOMYCOSIS.

When the cattle affected with actinomycosis were placed under treatment 21 healthy cattle were placed among them in the stables in such a way that they would be most exposed to the infection of the disease. The healthy animals were tied between diseased ones, where they were obliged to eat food soiled with the discharges from the tumors, and where they could not but inhale the breath warm from the lungs. There would appear to be no way possible of making a more severe test, and yet after being in such proximity with diseased animals for four months not a single one showed signs of being affected either while alive or on post-mortem examination after they were slaughtered.

DOES THE IODIDE TREATMENT DRIVE THE DISEASE TO THE INTERNAL ORGANS?

In a weekly agricultural journal printed in Chicago appeared a statement, under date of December 7, 1892, of the results of the post-mortem examinations made of the 80 cattle slaughtered on November 29. This statement was evidently inspired by the State veterinarian, or one of his assistants, as the post-mortem notes of each case as taken by these officials were given in full. In this statement occurs the following language:

> From the experiment just concluded we learn conclusively that iodide of potash has an effect upon cattle afflicted with actinomycosis, and possibly that it may curé simple cases characterized by glandular swellings or abscesses not attached to the bone. The general effect, however, is more of a dangerous than beneficial character as regards severe cases of lumpy-jaw, where suppurating tumors implicating the bones are noticeable about the head. Used in such cases iodide of potash apparently causes a superficial drying up of the suppurating sores which might lead the owner to believe that a cure had been accomplished, when, on the contrary, such external effects are no safe criterion of internal conditions. The post-mortem examination of animals so healed externally developed serious trouble within, trouble that had evidently been carried by the blood and possibly driven inwards by the drug employed.

The question now is, Was there anything in the results of the examination to justify the conclusion that there were more internal lesions than are usually found in animals affected with actinomycosis? So far from this being the case, there was a very much smaller proportion of the animals affected internally than was to be expected. The State veterinarian and his assistants are certainly the last people who would be expected to give the impression that a larger proportion of these animals were affected internally than is usually found.

The following table is compiled from the reports of the Illinois board of live-stock commissioners for 1890. It shows the proportion of untreated animals which were found affected in the lungs or abdominal organs:

Date of examination.	Number of animals examined.	Number affected internally.	Page of report where recorded.	By whom examined.
Mar. 11, 12, 1889	5	5	17	Dr. Baker.
Dec. 6, 1889	3	3	27	Drs. Casewell, Scott, Williams, and Page.
Aug. 11, 1890	55	43	19	Drs. Baker and Hughes.
Aug. 14, 1890	34	23	19	Do.
Total	97	74		

Fully 76 per cent of these animals were, therefore, affected in the lungs or abdominal organs. Now, taking the notes of the State veterinarian as published in the paper above mentioned, we find that they admit 55 of the animals had actinomycosis at the time of slaughter, while they found lesions of the lungs and abdominal organs in only 23; that is, turning all the facts so that they will bear as much as possible toward this view that the iodide treatment tends to develop the disease internally, we find that, of the 55 affected animals which had been treated, but 42 per cent were affected internally, as against 76 per cent found with untreated animals by the State veterinarian and his assistants.

This, however, is not a fair statement of the case, because 80 animals, every one of which had the disease before treatment, were examined, and of these only 28¾ per cent were found affected internally at the time of slaughter. And this is taking the statements of men who were doing everything in their power to disparage the results of the experiment and make it appear valueless.

As a matter of fact, the statement referred to, which was printed from the notes of the State veterinarian, does not correspond with the records of the Bureau inspectors. Dr. Norgaard dictated a record of the condition of each animal as examined to a stenographer, as the examination was made, and this record is the only accurate one that exists. From this official record it appears that seventeen of the animals reported by the State veterinarian to have internal lesions of actinomycosis did not have such lesions. Some of them had small nodules along the intestinal walls, which are common in healthy cattle, but when these were examined microscopically they were shown not to be affected with the actinomyces. There are several other cases reported with internal lesions, the numbers of which do not correspond with the numbers of any of the cattle slaughtered. There was evidently an error in printing the numbers of these animals, and I am unable for that reason to compare the notes with those made by Dr. Norgaard. Taking the examination made by Dr. Norgaard, therefore, as a basis for calculation, we find that among the 80 cattle killed on November 29 there were but 4 which showed internal lesions caused by the actinomyces fungus. As 20 additional animals were killed and examined on December 2, in none of which any trace of internal lesions was found, the result was that in the 100 animals first slaughtered but 4 per cent showed evidence of the disease having affected the internal organs located in the thorax and abdomen.

The proportion of animals affected internally was very much less than was expected, and it is conclusively demonstrated by this fact that the iodide of potassium reduces the proportion of internal lesions and that it has fully as wonderful an effect on these as it has on the external lesions. This is precisely what we should expect from internal and constitutional treatment. If the remedy had been applied externally and caused the tumors to heal from the surface, there might have been some reason for anticipating a change of the seat of disease from external to internal organs. Being, on the contrary, administered internally, the remedy penetrated the whole organism, acting upon the internal organs at the same time as upon the external tumor, and the effect was not only to prevent the extension of the disease, but to cure any manifestations of it which may have existed in the interior of the body.

It can not be stated too emphatically nor repeated too often that the State veterinarian and his assistants carried out their examination with the determination to disparage the results of the experiment. Every inch of the intestines and every portion of the internal viscera were scrutinized in the most deliberate and anxious manner. The least abnormal sign, though it affected tissue of no greater magnitude than the head of a pin, was set down as a serious internal lesion caused by the actinomyces. Inspection of Dr. Norgaard's notes will show that in a number of cases these lesions were examined microscopically and were proved to be free from the actinomyces germs. Anyone who examines the intestines of healthy cattle will find in their walls, in a considerable proportion of cases, such small tumors, which have not the slightest effect upon the health, and which in many cases are caused by animal parasites. To set these down as internal lesions of lumpy-jaw is to show either deplorable ignorance of the subject or deliberate falsification of the facts.

On January 23, 1893, the Secretary of Agriculture informed Governor Altgeld that the cattle remaining in the experiment were ready for slaughter, and requested the removal of the quarantine for that purpose. The governor immediately replied by telegraph that he had directed the board of live stock commissioners to permit the removal of the animals.

The 85 animals which had been under treatment were slaughtered on January 27 and 28 at Hess Brothers' slaughterhouse. There were present, besides the Chief of the Bureau of Animal Industry, the following members of the Bureau force: Dr. A. D. Melvin, chief meat inspector at Chicago; Dr. W. S. Devoe, chief inspector for New Jersey; Drs. V. A. Norgaard and L. R. Baker, meat inspectors at Chicago; Dr. M. R. Trumbower, State veterinarian of Illinois, and the inspectors of the Chicago department of health.

The number found on post-mortem examination to be cured was 68, or 80 per cent of the whole number. Of the 17 condemned as not cured there were internal lesions of actinomycosis in the lungs of three. About 4½ per cent of this lot of animals, therefore, showed internal lesions.

Of the whole number under treatment, which were killed and examined, viz, 185, there were found to be cured 131, or about 71 per cent. The number showing internal lesions was 7, or 3.8 per cent of the animals in the experiment.

This result is extremely gratifying, and proves that a large proportion of the advanced cases of actinomycosis are curable by the internal administration of iodide of potassium. If taken in the early stages of the disease, there is no doubt that 85 or 90 per cent would yield to this treatment.

THE COST OF TREATMENT.

It has been repeatedly stated by those who have opposed the Department in its effort to relieve the cattle owners from the injustice which has been practiced upon them at Chicago, by giving them a specific treatment for this disease, that farmers can not afford to use a medicine for this purpose which costs $3 a pound. Let us examine this statement in the light of the facts.

The result of the experiment shows that about two-thirds of the lumpy-jaw steers which come to the stock yards can be cured. If they were taken in an earlier stage of the disease the proportion would be much larger. Taking, however, two-thirds as a basis of calculation, we will see what would be the result on twelve animals averaging 1,200 pounds in weight. If shipped without treatment and condemned they would bring $9 per head, or $108 in all. If treated with the same success as the animals in the Department's experiment, there would be 8 cured ones, which would bring not less than 4 cents per pound in good flesh, or $48 per head. This would amount to $384 for 8 head, to which should be added $36 for the 4 not cured, making a total of $420 receipts as against $108 if not treated. The medicine does not cost over 7 cents for each day it is administered, and no animal should receive over 1 pound in all. Taking the largest figures and the medicine for treating 12 steers would cost $36. Deducting this from $420, we have remaining $384, a gain of $276 in all, or $23 per head over what would have been received if the cattle were not treated. It must be plain to every experienced cattle feeder that there is no other known medicine, nor indeed any kind of food, which can be given to his animals with a prospect of such returns for the money invested.

It is difficult to understand the motive which will lead men to make such absurd objections and such incorrect statements in regard to a discovery which must prove of such incalculable advantage to the farmer without in the least injuring any other class of our citizens. It appears, however, that certain parties have committed themselves so irrevocably to the position that actinomycosis is a dangerously contagious and incurable disease that they are willing to go to almost any length to prevent the overthrow of this theory. The action of the Illinois live stock commissioners, for instance, made it difficult to obtain cattle for experiment. They quarantined the cattle in the stock yards so that until the governor interfered they could not be taken to the stable for treatment. After the cattle were taken to the stables they were again put in quarantine until the governor ordered them released for a second time. Incorrect reports were sent out apparently on authority of the board, giving the impression that the results were less favorable than was actually the case. Other statements were made as to the proportion of isolated cattle condemned by the board, and as to the proportion affected internally, which are at variance with the records given in the printed reports; and after the quarantine was removed from the cattle under experiment it was again imposed on December 31, when the results of the first killing became known. If these several actions were not taken in the first place with a view to preventing the experiment being made, and afterwards to disparage the results obtained, and to delay the completion of the test, it is impossible for me to explain them on any other hypothesis.

SUCCESSES OBTAINED BY INDIVIDUALS WITH THE IODIDE TREATMENT.

A considerable number of cattle-feeders have tested the treatment of actinomycosis with iodide of potassium, and their results, so far as reported, have been remarkably successful. Below are given some of the letters received:

BRADFORD, STARK COUNTY, ILL., *November 21, 1892.*

U. S. DEPARTMENT OF AGRICULTURE:

In October I received a circular giving treatment for actinomycosis. I tried it on 3 head of cattle, and it worked to a charm. I told other cattlemen, and several have tried the treatment. All are well satisfied but one, who informs me that he could see no change. His steer was very bad. The 3 I treated had not fully developed, and the veterinarian could not operate at the time. I therefore commenced treatment, and all swelling of the throat disappeared.

Yours, truly,

R. W. PHELPS.

VAN BUREN, ILL., *November 22, 1892.*

BUREAU OF ANIMAL INDUSTRY,
Washington, D. C.:

I treated 3 3-year-old feeding steers according to the advice contained in your circular of October 10, 1892, for actinomycosis, or lumpy-jaw, with iodide of potassium. One had a lump under the ear; one on the jaw, and one under and between the jaws. The first was 3 inches in diameter; the second about 3½ by 6 inches long, and the third about 5 inches in diameter. I commenced with 2 drams daily, and increased to 3 drams for twelve days, when the first named was entirely cured. I then gradually decreased to 1½ drams, and at the end of sixteen days the second was cured, the third being cured on the twenty-first day. The 3 head were all slaughtered at Chicago thirty-five days from commencement of treatment.

Yours, very respectfully,

L. A. KEENE.

WELTON, CLINTON COUNTY, IOWA, *November 26, 1892.*

DR. D. E. SALMON,
Chief of the Bureau of Animal Industry:

I received a circular from your Bureau on October 18, with instructions for the treatment of lumpy-jaw in cattle with iodide of potassium. The cow I treated is 4 years old, and was bought at a sale for a trifle on account of her jaw. I thought I could cure it with corrosive sublimate, but failed. The jaw had been affected for a year before I began the iodide of potassium treatment. I had it lanced several times, and for two months it had been running almost constantly. I began the treatment on October 22, and gave 1½ drams every morning for ten days, then every alternate morning for a week, and the lumps are gone and the sore healed up. The cow now appears to be beginning to thrive. In this case, and it was a radical one, the treatment has been a positive success.

Respectfully yours,

JOHN HOWAT.

KING CENTER, MO., *December 2, 1892.*

DEAR SIR: I have been reading of your experiments with iodide of potassium. I would like to tell you of my experience with it. I have been treating "big-jaw" with it for more than a year, and have cured more than twenty cases. * * *

A. J. WHEATLEY.

HON. J. M. RUSK,
Secretary of Agriculture, Washington, D. C.

CRESTON, IOWA, *December 5, 1892.*

DEAR SIR: I tried your remedy for lumpy-jawed cattle on 5 steers out of my herd, and it has proved successful in each case.

DANIEL D. DORN.

Hon. J. M. RUSK,
Secretary of Agriculture.

WARSAW, IND., *December 19, 1892.*

DEAR SIR: Some two months ago I asked the Department for a bulletin on "lumpy-jaw." I had a 2-year-old Durham heifer with a lump on her jaw the size of a small hen's egg. I purchased 1 ounce of the prescribed remedy, iodide of potassium, divided it into eight portions, and gave as directed, in bran. I saw no change except the softening of the tumor. I bought another quantity, and after a rest of a week gave it in the same manner. The lump has disappeared, except a small callous. The animal's eyes became weak, which is the only change I could see. The last ounce of the remedy I gave in seven doses. I think the heifer is cured of the ailment.

Yours,

A. T. COOK.

Dr. D. E. SALMON,
Bureau of Animal Industry, Washington, D. C.

ALGONA, IOWA, *December 18, 1892.*

DEAR SIR: I cured 2 lumpy-jaw heifers, a 3-year old and a 2-year old, giving each 1 ounce of iodide of potash, in six doses, two months ago, and as yet there is no sign of a return of the disease.

Very respectfully,

R. W. BARRETT.

Hon. J. M. RUSK,
Secretary of Agriculture.

KIANTONE, CHAUTAUQUA COUNTY, N. Y., *January 2, 1893.*

DEAR SIR: Some time ago we wrote you, asking if the Department had ever made an investigation of the lumpy-jaw in cattle, and we received in reply a circular containing the iodide of potassium remedy, and asked us to report results. We had two cases.

No. 1, a cow in milk, was taken in July. Had four different sores that discharged matter previous to treating her with this remedy. A local veterinarian had advised killing her. One of the sores has entirely healed; the other three are greatly diminished in size. Her flesh has dropped off until she is getting quite thin, and is at the present time and has been for the last three weeks, very stiff. Her eyes discharge very badly; nose but little, and the outer skin looks as if some one had poured her hair full of the coarsest bran. Her appetite is as good as any cow we have.

No. 2, a cow also in milk when taken, but dried off since. She was taken about middle of November, one bunch only. It did not discharge until broken by halter pulling on it. Had treated her ten days. The matter discharged was white, with a yellowish cast, and was very thick and sticky. She discharged from the nose very badly, and also from the eyes, but the outer skin cleaving off was hardly noticable in this case. She did not drop off in flesh, nor did she show any stiffness. The sore has greatly diminished in size, and think we will have to give her no more medicine, as all that remains is apparently dead flesh, and does not seem sore. We are highly pleased with the remedy so far.

Yours, truly,

S. SPENCER & SON.

Hon. J. M. RUSK,
Secretary of Agriculture, Washington, D. C.

VINE HILL, CONN., *January 27, 1893.*

Patient, thoroughbred Guernsey; age, 8 years; calved July 11, 1892. Observed bunch on left upper jaw November 1, 1892. At this time enlargement was about size of two fists, and very firm. Herdsman then reported to me he had observed swelling in August, 1892. For four days after November 12, administered 2 drams iodide of potassium twice daily. One week later repeated same doses for same period of time. From November 30, for seven days following, gave 2 drams once daily. About one week thereafter administered 1 dram once daily for ten days. From November 12 the swelling rapidly increased in size until November 27, when, at about the size of a man's head, it broke. In a few days indications of resolution set in, and for the past six weeks she has, to all intent and purpose, appeared to be perfectly recovered. At this date, the seat of attack is barely visible. The cow's appetite improved shortly after receiving first dose of the iodide, and milk secretion also increased.

F. H. STADTMUELLER,
One of the managers of the Vine Hill and Ridge farms, West Hartford, Conn.

FONTANA, MIAMI COUNTY, KANS., *February 1, 1893.*

DEAR SIR: I have tried iodide of potassium for the cure of lumpy-jaw in cattle on 12 head, as prescribed under the treatment made by your direction at Chicago. Nine head are entirely well; 3 need further treatment. Five head, with large, lumpy jaws, would have been worthless without the iodide cure. The balance might have got well without it, as they had only bad lumps. I have full 400 head of cattle this winter, and will not have a worthless steer amongst them. The experiment made by your direction has saved me $200 or $300. John Shean lost 10 out of his herd of 100 head from lumpy-jaw. He then tried the iodide of potassium remedy on two very bad cases, and cured them. I know lumpy-jaw can be successfully treated by farmers and feeders with iodide of potassium. Accept my thanks for the interest you take in the welfare of farmers.

Respectfully, yours,

FRED. MATHEWS.

Hon. J. M. RUSK,
Secretary of Agriculture, Washington, D. C.

Mr. J. W. Wampler, a stock-breeder of Brazilton, Kans., in a letter recently published in the Kansas Farmer, says:

I will tell you all I know about curing lumpy-jaw in cattle. Last summer I saw an account in some paper that Secretary Rusk wanted 300 head of lumpy-jawed cattle to experiment on, and he thought he could cure them. I wrote him to send me his remedy, and I would experiment, too, as I had three of my own, badly diseased. In a few days I received his answer, and also the remedy, and how different cattle had been treated.

The remedy is iodide of potassium. It costs 30 cents per ounce here in Girard, and 1 ounce will cure one animal if the disease has not gone too long. The longer the disease has run, the more of the iodide of potassium it will take. I use 1 dram in 1 pint of fresh water. It dissolves readily if well pulverized. This much I give to each animal every morning. Don't mix any more than you use each day, as it is better while fresh. Place a good leather halter on the animal and draw its head up by placing the strap or rope over something above. Place a cow horn in its mouth, then pour the medicine through. Repeat every morning unless the animal gets to running too much at the nose, so much that it interferes with its breathing, then stop a day or two, and commence again, and so on, until the animal is well, which, if the disease is not too old, will be in ten or fifteen days.

I have a fine heifer that was badly affected for over a year. The lump on the left side of her head was half as large as her head, and had become honeycombed and running. I fed her 5 ounces and then quit, thinking the disease had gone too far, and let her run, thinking I would kill her and drag her away. We were busy sowing wheat, and did not notice her for some two weeks. I then went to look at and arrange to kill her, as I did not want her to be with the other cattle, but was surprised to see the lump half gone and the remainder soft, and it has been going away ever since, and now she is well.

I cured two steers, also, that had not run so long. One I fed 1 ounce and the other about 2 ounces. I told a neighbor who had three badly diseased. He cured them all. Another neighbor cured three. Another had one that was fat, but had a lump on jaw. He tried to sell it to a shipper, but he would not take it for a gift. He tried the remedy, and in two weeks she was well. He sold her and she went to

Kansas City, passed the inspection, went on the market, and he got a good price for her.

Don't get scared if they run at the eyes and nose and the outer coat of skin peels off, like the hair was full of bran, for this is characteristic of the effects of the iodide. The cattle will fatten while under treatment, and so much better and faster afterward, that I am convinced that it would pay to treat all cattle to about 1 ounce to purify the blood and system, especially those put up to feed.

I have given to others that I have not heard from yet, except one that had two steers diseased. I saw him the other day, and asked him how he succeeded in curing the lumpy-jaw? He said he had bought the medicine and laid it up in the kitchen cupboard, and it was there yet. So you can see his cattle have the lumpy-jaw yet.

Tell the people not to buy the medicine unless they intend to use it, and use it right and regular. I will give anyone all I know about curing lumpy-jaw if they will write me, inclosing stamp, and not charge anything, feeling that what is good for me is good for my neighbors.

The report of Dr. V. A. Norgaard is hereto appended.

REPORT OF DR. V. A. NORGAARD, INSPECTOR IN CHARGE.

CHICAGO, ILL., *February 6, 1893.*

SIR: I have the honor to submit herewith a report upon the results of experiments in the treatment with iodide of potassium of cattle affected with actinomycosis.

Very respectfully,

VICTOR A. NORGAARD,
Veterinary Inspector.

DR. D. E. SALMON,
Chief Bureau of Animal Industry.

THE MEDICINE.

It has already been mentioned that the medicine used in treating actinomycosis is iodide of potassium. This is a common drug and may be obtained at any drug store, the price being about $3 per pound.

All the iodine salts have a faint antiseptic power, which is produced by the iodine getting free under a prolonged influence of various organic substances. A 5-per cent solution of iodide of potassium will render tuberculous sputum inactive in about twenty-four hours.

Iodide of potassium has a strong absorbing effect when given internally, especially on all pathological accumulations of cells. In connection with protoplasm, carbonic acid and water, the iodine will become free and combine with the cells in the pathological product, which will decrease their vital power and accelerate their absorption. It still remains to be explained in what that specific effect consists which the iodine salts have on the actinomyces fungus. Several prominent authorities have investigated the subject, but all have given a different explanation. Nocard succeeded in cultivating actinomyces in gelatine containing 1 per cent of iodide of potassium, but this proves nothing, as the salt in this case will remain unchanged, and in that form has not even a slight antiseptic power. It is not necessary, however, that the iodine should have a specific influence on the fungus to produce that remarkable effect which the drug evidently exercises on all actinomycotic new formations. This effect may simply be attributed to the strong absorbing power which iodide of potassium exercises on all pathological neoplasms and waste products. The colonies of actinomyces, when living and possessed with regenerative power, are always imbedded in a small amount of liquefied tissue surrounded by a wide zone of inflammation. When an actinomycoma consists exclusively of granulomatous tissue and connective tissue the fungus is dead, or at least dying (Bostroem).

It will therefore be understood that the liquefied tissue surrounding the parasite under the influence of the administered iodide of potassium will be absorbed, the soft granulomatous tissue when partly deprived of the necessary pabulum by absorption will undergo a degenerative metamorphosis, and the round cells be converted into spindle cells, and the whole actinomycoma in this way will be turned into an inert mass of fibrous tissue, inclosing the dead calcified actinomyces tufts.

The yellow pus-like substance in which the living actinomyces is always imbedded is not true pus, though it has that appearance, but is merely the product of a degenerative metamorphosis (necrobiosis). True pus must contain pus corpuscles and specific pus-producing micro-organisms (pyogenic cocci and bacilli) (Bostroem).

Where iodide of potassium is administered in medium doses for any length of time it will affect not only the diseased parts, but the liberated iodine will combine with the normal cells in the body and produce a series of symptoms called iodism. This consists of a general emaciation, shrinking of the fat, atrophy of lymph glands, and of mammary glands, in connection with a chronic catarrh of nose and conjunctiva, and desquamation of the epidermis. When given in overdoses it will produce a catarrh of the stomach and intestines, and even cause hemorrhages. The manure will get dry and hard and coated with thick mucus, or eventually with blood. All these inconveniences, however, are easily avoided when the medicine is given in proper doses, care being taken that the animal gets plenty of nutritious and easily digestible food. It is not, however, advisable to administer iodide of potassium to milch cows, as it will reduce the milk secretion considerably or stop it altogether. Furthermore a great part of the drug is excreted through the milk, making it unfit for any use. When administered internally the drug permeates all the tissues in the body, even the muscles and bones, but it is, however, rapidly excreted again, especially through the urine and milk.

In treating actinomycosis in cattle with iodide of potassium the dose should never exceed one gram (¼ dram) for every hundred pounds live weight, the proper dose being from 8 to 12 grams (2 to 3 drams) according to the size of the animal and the extent of the lesion. This dose may be given from five to six days, when the animal will show slight symptoms of iodism, viz, discharge of thick mucus from the nose and excretion of tears. The manure will become rather dry, but that is easily repaired by giving a dose of glauber salts and some bran mash. This will restore the appetite, and two days after the last dose is given the animal will be ready for another week's treatment, and so on until a cure is effected. If these precautions are taken no ill effect will result from the treatment, and if properly fed the animal will gain in condition uninfluenced by the medicine. There is, however, a great difference as to the individual effect of the medicine on animals, but any farmer who takes an interest in seeing his stock doing well will easily perceive when it is time for him to stop and give the animal rest for two or three days.

The medicine is best administered dissolved in water and given by means of a slender, long-necked bottle, for example, a common Rhine-wine bottle. One dose of medicine is dissolved in about a pint of water; the steer is seized by the nose to hold up the head, and the contents of the bottle are emptied into the mouth without fixing or securing the tongue in any way.

Where a man has several head of lumpy-jawed cattle to treat they may not be of the same size, and therefore will not require the same dose of medicine. As the farmer or breeder is not usually in possession of a pair of scales sufficiently fine to weigh off such small doses as required, the most convenient way is to have the medicine, which is easily dissolved, prepared in a concentrated solution of the strength 1 to 2 (2 drams of the solution to contain 1 dram of iodide of potassium). The drug must be dissolved in distilled or rain water, as otherwise a precipitate will form from the salts present in common water. With such a concentrated solution and a measuring glass it is easy to measure out the exact dose for every animal and pour it into the wine bottle, half filled with common water.

EFFECT OF IODIDE OF POTASSIUM ON THE DIFFERENT ACTINOMYCOTIC NEW FORMATIONS AND THEIR TISSUES.

To give a detailed description of the various forms under which actinomycosis appears in cattle is not necessary here, as there is an abundance of literature on the subject. It shall only be mentioned that, from a therapeutic standpoint, we may divide them all into two classes: (*a*) those where the bones are involved, and, (*b*), those where only the soft tissue has become affected.

Of the 150 head experimented on, about sixty had lesions where the bone was affected. These may again be divided into two classes: first, where the lesion is located on the lower jaw, which is by far the most common, and, second, those where the facial bones and upper maxilla have become affected. In both cases the lesion has been produced by an invasion of the germ, by means of a spikelet of barley or some other stiff vegetable particle, on which the germ has vegetated in nature. No other satisfactory explanation of the infection has been given so far, whether the invasion occurred through a decayed tooth or through some abrasion in the mucous membrane in the mouth, on the tongue, or in the pharynx. Bostroem has examined thirty-two cases of actinomycosis in the jaw bones, minutely, and in every case he found some vegetable particle located in the socket of the decayed molar, or in the gums, or even as deep as in the center of the swollen rarefied bone. Where the tongue is affected these foreign bodies may be found in almost every one of the nodules, and a microscopical examination will show them to be closely covered with actinomyces. In five cases of actinomycosis in human beings, this authority has traced the infection back to the same origin, and thereupon advises people who may have that habit not to chew a piece of straw or to put grain, especially those kinds which are armed with a spikelet, in their mouths, as he feels satisfied that this is the only way in which an infection can take place.

Where the lesion has only affected the soft tissues, the most common appearance is in form of a hard, round or egg-shaped tumor, lying loose in the connecting tissue under the skin, usually in the submaxillary, sublaryngeal, or parotid region. The tumor may vary in size and character, ranging from a walnut to a child's head and from being hard and solid to soft and fluctuating. In almost all cases, bony or soft, the skin that covers the tumor or swelling is more or less indurated and may on the large bony swellings obtain a thickness of 2 or 3 inches. These fibrous indurations, however, show a pronounced inclination to shrink where iodide of potassium has been administered for some time, and will, in most of the cases, disappear altogether, leaving the skin in its natural condition.

The first step toward a medical treatment of actinomycosis was when M. Thomassen, of Utrecht, in 1885, announced that he had successfully treated actinomycosis in the tongue of cattle by giving iodide of potassium internally and applying tincture of iodide to the ulcers on the tongue, which he first scraped. Since then this experiment has been repeated all over Europe by many different authorities and practitioners, with similar success. This lesion, however, is very seldom seen in this country, but seems to be rather common in Germany and certain parts of England. Of all the cattle in this experiment, not one had actinomycosis in the tongue, and the inspectors in the stock yards have only seen it two or three times. The reason for this may be that actinomycosis in the tongue has a comparatively acute progress, and that an animal so affected rapidly loses in flesh if medical treatment is not adopted. Now we know, however, that we can always master a case like this, even if the tongue is swollen to such a size that it protrudes from the mouth and is as hard as a board. Give 10 grams (2½ drams) of iodide of potassium a day, in the above-described way, care being taken to give the animal time to swallow the medicine, as deglutition is impaired considerably by the hard and swollen condition of the tongue. Feed the animal gruel and other fluid food, with a bottle if necessary. In ten to twenty days the tongue will regain its natural size and condition and the animal be enabled to eat hay.

Though none of the cattle in this experiment had the lesion in the tongue, several of them had it in the mucous membrane in the mouth, especially on the inside of the lips, but not to any great extent. It appears as small, flat tumor formations, the size of a dime to that of a fifty-cent piece, of a reddish-gray color and only protruding a little over the surrounding parts. They will shrink and disappear completely in about two weeks when medicine is administered regularly.

When a medium dose of iodide of potassium has been administered from three days to a week, symptoms of iodism will appear, and at the lapse of two or three weeks a desquamation of the epidermis will take place, especially on the neck, shoulders, and rump. But there are many exceptions. Some animals will show only a slight catarrh of the nose and none of the conjunctiva, while the desquamation will not take place before a month or six weeks, or may not occur at all. Several of the steers experimented upon showed under the whole treatment not a single epidermic scale on their body, even if the dose of medicine was increased up to 15 grams a day. They would get a catarrh of the intestines, with constipation, but show no external symptoms of iodism. Such an insusceptibility of the constitution usually extends to the actinomycotic lesions, which would remain almost unaffected or only improve slightly. There are, however, also exceptions here, as one steer with a large tumor in the sublaryngeal space was almost completely cured without showing any epidermic desquamations.

INDIVIDUALS WHICH SHOW THE MOST PRONOUNCED SYMPTOMS OF IODISM WILL IMPROVE THE FASTEST.

The effect of the medicine is rarely alike in two individuals, even if they are affected exactly the same way and to the same extent. The hard fibrous tumors lying loose in the connective tissue under the skin will require a treatment of from three to six weeks with proper intervals, according to their size. But in many cases a tumor the size of a child's head will shrink and disappear faster than a similar one located on the same place in an animal of the size and condition, but with the tumor only as large as a goose egg; the former will show a pronounced iodism, while the latter will show little or none at all.

When one of these loose fibrous tumors becomes fluctuating and is left alone, it will break open after a while and a comparatively small amount of pus will be evacuated. The pus cavity will rapidly fill up with the soft granulomatous tissue characteristic of actinomycosis, and when it is full it will grow out of the opening like a mushroom and form a granuloma, which will increase in size very fast as long as the supply of nutrition is abundant, after which the surface will begin to ulcerate.

If the treatment is commenced at this time, say with a daily dose of 10 grams of iodide of potassium, the rule is that the ulcerating surface of the granuloma will dry up and the granuloma itself will gradually shrink, apparently as if it were drawn in through the same hole it had grown out of. Then the fibrous parts of the tumor will commence contracting until the whole tumor has disappeared, leaving a small white cicatrix where the granuloma was. But here there are also exceptions. In some cases the granuloma may remain unaffected, while the fibrous parts begin to shrink first, and after awhile the granuloma will become dry, shrinking slowly, but not disappearing completely, although the actinomyces are killed or rendered ineffective by the treatment.

When the disease affects the bony parts, the periosteum will become covered with thick layers of connective tissue inclosing centers of soft granulomatous tissue, and when it penetrates into the internal parts the bone will increase in bulk in two different ways, either by a rarefying granulating ostitis or by an ossifying periostitis. The invading germ will cause an irritation, which will be followed by a formation of granulomatous tissue in the cancelli of the spongiosa and in the Haversian canals. The bony plates of the former and the walls of the latter will be destroyed and replaced by large pockets, or alveoli, filled with soft granulomatous tissue and with a creamy, viscid, pus-like mass, containing numerous actinomyces.

The proliferating granulomatous mass will finally penetrate the surface of the bone and infiltrate the covering tissues, and at last break through the skin, which will become thick and indurated and form a bulky fibrous wall around the fast-growing granuloma. The picture here described is that frequently seen on the lower maxilla. These tumefactions may attain enormous dimensions, and even reach the size of a half-peck measure, with granulomas 6 to 8 inches in diameter. Several specimens of this kind were included in the experiment, though such extreme cases practically never will be submitted to treatment.

Nevertheless, the effect of the medicine by far exceeded the expectations. With a few exceptions, they all showed wonderful improvement. Under the effect of a 12 to 15-gram daily dose, those large fetid ulcerating granulomas would dry up and shrink, most of them disappearing altogether, only leaving a white contracted cicatrix, while the fibrous parts of the tumefaction would become thinner every day and finally leave the swollen bone directly covered by the muscles and the skin. The post-mortem examination of these bony tumors revealed similar improvements. An incision through them showed the internal parts to be spongy, but the alveoli and pockets only contained very little granulomatous tissue, and this was not soft, but of a more elastic and dense character, and only contained calcified actinomyces. In many of them no pus was found at all, while others contained small quantities. This remarkable improvement was seen in all those cases where the iodide of potassium had caused a well-pronounced iodism, while in those cases where the medicine had a less pronounced effect the improvement was equally small and quantities of pus and soft tissue could be found in the alveoli. Similar to the loose-lying tumors, the medicine may in these cases have a stronger effect on either the granuloma or the fibrous parts of the tumefaction. The first is the most common, but in a smaller number of cases the medicine takes effect exclusively on the fibrous parts, making them shrink so rapidly that the thick fibrous wall surrounding the granuloma contracts to such an extent that the whole granuloma is expelled, partly by force and partly on account of obstructed blood circulation.

There is no doubt that these results, obtained by a treatment which in no case lasted more than seven weeks and as an average not exceeding five weeks, permit us to say that in iodide of potassium we have found a valuable remedy in treating actinomycosis.

It now remains to decide which cases will prove of financial value for the farmer and breeder to treat, and this partly depends upon the facility with which the administration of the medicine can be performed. The amount of medicine used in a single case ought never to exceed 1 pound, equal to an expense of $3. We suppose any steer will be worth that much. If the affected animals are being kept in a stable, as, for instance, in distilleries, the trouble about giving the medicine amounts to nothing. But where the animals are running loose in a pasture and there is no convenient place to tie them up it is no easy matter to catch them and secure them every day while the medicine is given. On ranges and similar places, where several hundred head of cattle are kept, the easiest way is to keep the affected cattle in a large pen, in the one side of which is built a narrow chute, into which the cattle can be driven one by one and treated. Such a chute may be constructed out of a few solid boards without much expense. To administer the medicine in the drinking water is not advisable, as it is then rather difficult to control the right dose. The cattle will not drink a pailful of water with a dose of iodide of potassium, except when they are very thirsty.

As to the different lesions, it has already been said that when the tumor is not connected with the bony tissue, but is lying loose in the connective tissue under the skin, a favorable result may be expected in from two to five weeks, according to the size of the tumor and to the susceptibility of the individual toward the effect of the medicine.

It is not necessary to continue the treatment until the tumor has disappeared completely, but it may be stopped when it has shrunk to about one-third of its original size, and the remainder will usually disappear without further treatment. When a small tumor about the size of a hen's egg is located on the cheek or on the outside of the lower jaw, it is usually very hard and can only be moved very little, so it is easily mistaken for a bony tumor. A careful examination, however, will soon prove that it is not bony, and when treatment is commenced it will rapidly decrease in size.

When the bone is affected, treatment is only advisable when the swelling does not exceed a goose egg in size on the lower jaw or a walnut on the upper jaw, and has not penetrated the skin; but in any case the medicine will avert a further development of the disease if the animal is at all susceptible to its effect.

Two cases as above described, and with a small bony tumor on the lower maxilla, were killed on October 29, 1892, after a six weeks' treatment. The bony swellings were then almost solid, contained no large cavities and no traces of pus or soft tissue. In the center of them was a bunch of white connective tissue, and from this extended a cord of the same material to the socket of the first molar. This was an obliterated fistula. The molar was not decayed and was firmly embedded in the socket. This is a clear proof that actinomycotic lesions in the bony tissue can be successfully treated when they are taken in time.

TREATMENT AND POST-MORTEM EXAMINATIONS.

November 29, 1892, two lots of cattle experimented upon were killed. Each lot contained forty head, the one consisting of cattle that were supposed to be completely cured, while the second lot included all the old chronic cases, where a successful result could not be expected in the time limited for the experiment.

In the special report of each animal the description of the post-mortem examination will be found. This is necessarily very brief.

The forty cattle which were supposed to be cured proved to be so with the exception of two, which had small actinomycotic tumors in the lung containing living actinomyces. In nine other cases traces of the disease were found at the place where the tumors had been located, but these traces were so insignificant, ranging in size from a pin's head to a bean, that they did not amount to anything.

The first lot were all in good condition, some of them very fat, and the greater part of the second lot also were in a very satisfactory condition, only a few of them being really poor. A noteworthy fact is that only two out of each lot had actinomycotic lesions in the internal organs, all cases in the lungs. This would hardly have been the case if the cattle had not been treated. In some cases a few small nodules, in size from a millet seed to a pea, containing a cheesy, greenish detritus mass, were found in the wall of the small intestines, but a microscopical examination of these lesions gave negative results with regard to actinomycosis. The final result of the investigation was that out of the first lot thirty-eight were passed as fit for human food, while the two cases affected with actinomycosis in the lung were condemned. Of the other forty only five were passed and thirty-five condemned, though many of them were big fat steers with the lesion located on the jaws and no internal lesions of any kind. The tumors on the greater part of these did not contain any pus, and the granulomatous tissue had undergone a fibrous metamorphosis, and subsequently did not contain any actinomyces possessed with regenerative power.

December 2 twenty more head of cattle were killed. These had been stabled in the same barn as the rest and had been treated from three to six weeks each with proper intervals. They were all used to the distillery slops before the treatment began, and continued to grow in flesh while they were treated. They were all pronounced cases, but only the soft tissues were involved. The lesions were about the same as those in the first lot, hard, fibrous tumors, the size from a goose egg to a child's head, located in the loose connective tissue under the skin in the submaxillary or sublaryngeal space. They all recovered completely, and at the post-mortem examination no traces of the disease were found except in two cases, a hard, fibrous induration in the skin, where the tumors had been. They were all passed as fit for human food.

The notes in regard to the treatment and the post-mortem examination of the individual cases are as follows:

POST-MORTEM NOTES OF CATTLE TREATED.

No. 533796.

Dark-red hornless steer; received August 22.

In the submaxillary space is located an oblong tumor extending from the chin to the neck, with a dependence of 4 inches. The tumor is of a fibrous condition, but not very hard. In the parotid region on the right side is located a hard, fibrous tumor the size of a goose egg. (See Plate VII.)

Treatment was commenced August 24, with a daily dose of 12 grams, and was continued until September 13, at which time the swelling underneath had disappeared and the tumor in the parotid region had shrunk considerably. October 20 the tumor in the parotid region was swelled a little and fluctuating. It was opened with a knife, and a small amount of pus discharged. Medicine was again administered for two weeks, and by November 12 the steer was regarded as cured.

Post-mortem, November 29.—Skin under submaxillary space indurated. Fibrous scar in parotid region. No traces of actinomycosis. No internal lesions. The carcass was passed as sound.

No. 45982.

Roan steer, white sides, hornless; received September 5.

In sublaryngeal space on left side is located a hard fibrous tumor the size of a double clinched fist, extending up in parotid region toward the ear. The lower part of the tumor is lying loose under the skin, but the part in the parotid region is in close connection with it. (See Plate III.)

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 12, by which time the tumor had shrunk to the size of a walnut and only left a fibrous induration in the skin in parotid region. The steer was considered cured about October 15.

Post-mortem, November 29.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 39976.

Dark-red steer, white face and rump, horns; received August 28.

In sublaryngeal space in left side is located a fibrous tumor the size of a child's head. The tumor is not quite as hard as is generally the case, but is closely connected with the skin. (See Plate VI.)

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 1. Two weeks later no traces of the tumor could be felt, but in the skin was still left a thick fibrous induration. Medicine was again administered until November 1, by which time the skin had almost regained its natural condition. About November 10 the steer was considered cured.

Post-mortem, November 29.—Slight thickening of the skin in sublaryngeal space. No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 39963.

White roan steer, hornless; received August 28.

In parotid region on the left side is located a tumor the size of a large goose egg, which at the lower end extends into a hard fibrous swelling, filling the intermaxillary and sublaryngeal space, depending about 5 inches below the throat. (See Plate IV.)

The treatment was commenced August 30, with a daily dose of 10 grams. The medicine had a good effect, causing a strong catarrh of nose, mouth, and conjunctiva, and made the tumor and swelling shrink rapidly. After four weeks the treatment was stopped, and the steer regarded as cured about October 10.

Post-mortem, November 29.—The skin that covered the tumor a little indurated No traces of the disease left here nor internally. The carcass was passed as sound.

No. 499857.

Red steer, white star, rudiments of horns; received August 16.

In the sublaryngeal space on the right side is located a tumor the size of a clinched fist. The tumor is hard and fibrous, with a smooth surface and lying loose under the skin. (See Plate VIII.)

The treatment was commenced August 18, and continued for three weeks with daily dose of 10 grams. The medicine had a strong effect on the steer, and by September 12 the tumor had completely disappeared. In spite of a well-defined iodism the steer did not lose flesh under the treatment, but his condition improved considerably.

Post-mortem, November 29.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 545801.

Speckled dehorned steer, white face; received August 22.

In sublaryngeal space on right side is seen a tumor the size of a clinched fist, located in loose connective tissue under the skin. The tumor is hard and fibrous with no evidence of having been opened. (See Plate V.)

Treatment was commenced August 24; daily dose, 10 grams. The tumor began to shrink from the fourth day, and in less than three weeks it had gone down to the size of a walnut. The steer was then covered all over with epidermic scales, and was considered cured about October 7.

Post-mortem, November 29.—No traces of the disease were found either on neck or internally. The carcass was passed as sound.

No. 545523.

Brindle steer, hornless; received August 16.

On the outside of the right cheek, near the lower edge of the inferior maxilla, is located a hard fibrous tumor the size of a goose egg. The tumor is situated in the short connective tissue under the skin. In submaxillary space there is a similar tumor the size of a double clinched fist. (See Plate VII.)

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until September 12. The steer showed a pronounced iodism and the tumors shrunk rapidly. When the treatment was stopped the tumor in submaxillary space had disappeared, and the other one had shrunk to the size of a walnut. October 1 the steer was considered cured.

Post-mortem, November 29.—No traces of the tumors left, except a slight induration in the skin. No internal lesions. The carcass was passed as sound.

No. 534024.

Brindle steer, horns; received August 22.

On left cheek outside second molar is located a hard fibrous tumor the size of a walnut. It is situated in the short connective tissue under the skin and can only be moved very little. In the intermaxillary space there are two tumors, the foremost one a little larger than the above mentioned, and the other one about the size of a double clinched fist. (See Plate V.)

The treatment was commenced August 24, with a daily dose of 10 grams. Two weeks later the two smaller tumors had disappeared, and by September 20, when the treatment was stopped, there was only a small part of the largest one left.

Post-mortem, November 29.—In intermaxillary space was found a small fibrous induration the size of a robin's egg. The surrounding lymph glands were a little swollen, but sound. The carcass was passed as sound.

No. 545512.

Red dehorned steer, white triangular spot on left side; received August 16.

On the left cheek are located four hard fibrous tumors from the size of a walnut to a hen's egg. They form a line from the angle of the mouth toward the back edge of the jaw, the last one being located a little below the ear. They are very hard and can only be moved slightly. In sublaryngeal space on left side is located a tumor the size of a double clinched fist. (See Plate IV.)

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until September 10, at which time the four tumors on the cheek had disappeared and the one on the throat had shrunk to the size of a hen's egg. September 25 the steer was regarded as cured.

Post-mortem, November 29.—One of the sublaryngeal lymph glands contained a small actinomycoma the size of a bean. No traces left of the tumors, excepting a small induration in the skin covering the throat. No internal lesions. The carcass was passed as sound.

No. 39964.

Red spotted steer, white star; received August 28.

The right lower maxilla is swollen to the size of a goose egg, between the incisor and the first molar. The bony swelling is covered with a layer of fibrous tissue, which makes the swelling appear the size of a double clinched fist. In the submaxillary space are a couple of small soft swellings the size of walnuts.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 30, with proper intervals. By this time the swollen glands in the submaxillary space had regained their normal size and condition, while the tumor on the jaw had only shrunk very little, but had become considerably harder. Only on the lower part of it was left some of the fibrous covering. The bony swelling seemed to have increased a little in size, while the fibrous tissue was absorbed.

Post-mortem, November 29.—Small fibrous infarct in sublingual lymph gland. The bony swelling was spongy, but did not contain any pus cavities. It was covered by a thin layer of fibrous tissue, which, on the lower side of the swelling, inclosed a small soft granuloma. In the wall of the small intestines were located a few small round hard nodules.* One of the mesenteric glands was a little enlarged. By the microscopic examination no actinomyces were found in any of these. No other internal lesions. The carcass was passed as sound.

No. 545742.

Brown steer, horns; received August 22.

On the right cheek, outside the third molar, is located a hard fibrous tumor the size of a hen's egg. In the submaxillary space there is another tumor the size of a cocoanut. The lower part of this tumor was fluctuating, and consequently was opened with a knife. It only contained about one ounce of pus. The rest of the tumor was hard and fibrous.

Treatment was commenced August 24, with a daily dose of 10 grams, and was continued until September 1, with proper intervals. The medicine did not have any strong effect, the tumors only shrinking slowly. October 7 there was still left a tumor the size of a goose egg under the jaw, while there only remained a small fibrous bunch from the tumor on the cheek. Medicine was then again administered for three weeks, and by November 12 the steer was considered cured.

Post-mortem, November 29.—No traces of the disease left except a small fibrous cicatrix on the cheek and a fibrous induration in the skin in submaxillary space. No internal lesions. The carcass was passed as sound.

No. 545559.

Light brown Montana-Texas steer; received August 16.

In right parotid region is located a hard fibrous tumor the size of a goose egg. In the submaxillary space on right side there is a similar tumor the size of a double clinched fist lying loose in the connective tissue under the skin.

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until October 1, with proper intervals. The steer showed no symptoms of iodism, the tumors shrinking only slowly, especially the one in the parotid region. From November 1 to November 15 medicine was again administered, and soon afterwards both tumors had disappeared, the upper one leaving a small fibrous induration on the angle of the lower maxilla.

Post-mortem, November 29.—No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 540519.

Black steer, dehorned; received August 16.

On the right side of the face, between eye and nose, is located a bony swelling the size of a hen's egg, with a scar on the top, indicating that it has been suppurating. On the right cheek, outside the third molar, is located a hard fibrous tumor, the size of a goose egg, lying loose in the connective tissue under the skin. In sublaryngeal space there is located another tumor the size of a double clinched fist.

The treatment commenced August 18, with a daily dose of 10 grams of iodide of potassium, and was kept up for four weeks, with the exception of one or two days a week. The tumor on the cheek and under the throat soon commenced to shrink, while the bony one broke open and discharged a little pus, after which it healed up again. At the end of the fourth week the two fibrous tumors had gone down to about one-third the original size, and the treatment was stopped. Three weeks later they had almost disappeared, while the bony one was exactly the same size as before the treatment. From October 15 to October 24 medicine was again administered daily, but the bony tumor remainad unchanged.

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*These nodules, which are frequently mentioned in the post-mortem notes, have nothing to do with actinomycosis or lumpy-jaw. They are very common in healthy cattle, and are caused by animal parasites.—D. E. S.

Post-mortem, November 29.—The bony swelling on right upper maxilla consisted of solid bone, and contained neither pus nor soft tissue. No traces were left of the other tumors. No internal lesions. The carcass was passed as sound.

No. 545797.

Red hornless bull; received August 22.

On the right lower maxilla, outside the first molar, is located a hard fibrous bony tumor the size of a clinched fist. In submaxillary space on left side is seen another tumor, the size of a child's head, lying loose in the connective tissue under the skin. The skin covering the lower part of the tumor is fibrous indurated.

Treatment was commenced August 24, with a daily dose of 10 grams of iodide of potassium, and was continued until October 15, with proper intervals. The tumor under the throat had then gone down to the size of a goose egg, while the fibrous parts of the bony swelling on the lower jaw had disappeared, leaving it bony, hard, and the size of a hen's egg. November 15 the tumor under the throat had disappeared completely, only leaving a fibrous thickening in the skin.

Post-mortem, November 29.—Fibrous induration in skin under throat. An incision through the bony swelling shows this hard and solid, with no cavities, but with a small fibrous mass in the center, from which the obliterated remainders of a fistula go up to the socket of the first molar. No lesions internally. The carcass was passed as sound.

No. 59141.

Dark red steer, hornless, roan face; received August 28.

The entire intermaxillary and sublaryngeal space is occupied by an oblong and rather soft tumor. The skin covering the tumefaction is indurated, and closely attached to the underlying tissue. The tumor depends about 5 inches below the lower edge of the under jaw.

Treatment was commenced about August 30, with a daily dose of 12 grams, and was continued until October 5, with proper intervals. The steer showed a pronounced iodism, and the tumor shrunk rapidly, but for a long while the skin remained very thick and indurated. This, however, disappeared slowly after the treatment was stopped. About October 20 the steer was regarded as cured.

Post-mortem, November 29.—In intermaxillary space is located a flat fibrous induration, about 2 inches long and 1 inch thick, inclosing a small abscess the size of a bean, containing thin yellow pus. No actinomyces were found by microscopical examination. No internal lesions. The carcass was passed as sound.

No. 45983.

Red steer, hornless, white star; received September 5.

On the left side of the face, about 3 inches below the eye, is located a hard bony swelling the size of a clinched fist.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until November 1. The steer showed a pronounced iodism, but the size of the tumor remained almost unchanged.

Post-mortem, November 29.—The thin fibrous covering on the bony swelling contained a few small pockets the size of peas. The contents of these pockets had originally been soft granulomatous tissue, but consisted now of a fibrous homogeneous mass of a light yellow color, but still bearing resemblance in structure to the former tissue, which during the treatment had undergone a fibrous metamorphosis. On the cut surface these centers protruded a little over the indurated tissue in which they were embedded, showing that they had been under a pressure. The internal parts of the bony swelling were spongy, but contained neither soft tissue nor pus. The lymph glands on the head were sound. No internal lesion. The carcass was passed as sound.

No. 40001.

Roan heifer, horns; received August 22.

The left cheek, from the eye down to the lower edge of the jaw, is covered by a hard fibrous tumor, which is fluctuating on the most prominent part. It was opened with a knife and a few ounces of good yellow pus evacuated.

Treatment was commenced August 24, with a daily dose of 10 grams, and was continued until October 10, with proper intervals. The heifer showed only slight symptoms of iodism, and the tumor only shrunk slowly. When the treatment was stopped another abscess formed in the same place, which was also opened. From October 20 to November 10 medicine was again administered, and the tumor was considerably reduced in size.

Post-mortem, November 29.—On the right cheek is located a fibrous induration about 1 inch thick and 3 inches in diameter, containing slight traces of soft tissue centers. The lymph glands on the head were sound. No internal lesions. The carcass was passed as sound.

No. 39974.

Spotted roan steer, horns; received August 28.

On the right lower maxilla, below the first molar, is located a fibrous bony swelling the size of a clinched fist. In the intermaxillary space there is a hard fibrous tumor about the same size, lying loose in the connective tissue under the skin.

Treatment was commenced August 30, with a daily dose of 12 grams, and was continued until October 20, with proper intervals. The steer showed a pronounced iodism, and the tumor in the intermaxillary space disappeared completely, while the swelling on the lower jaw was reduced to the size of a goose egg by the shrinking of the fibrous covering.

Post-mortem, November 29.—No traces of the fibrous tumor left, except a small induration in the skin. Surrounding lymph glands sound. An incision through the bony swelling showed this to be solid bone throughout, with the exception of a small bunch of white connective tissue in the center, from which a cord of the same material leads to the socket of the second molar. No internal lesions. The carcass was passed as sound.

No. 45594.

Dark red steer, horns; received September 12.

In the loose connective tissue in the submaxillary space is located a tumor the size of a double clinched fist.

Treatment was commenced September 14, with a daily dose of 12 grams, and was continued until October 10, by which time the tumor had shrunk to the size of a walnut. About October 25 the steer was considered cured.

Post-mortem, November 29.—Small fibrous induration in the skin in submaxillary space. No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 25873.

Dark red steer, hornless, white star and white spot on left hip; received September 12.

The intermaxillary space is completely filled from the chin to the neck with a fibrous swelling, which, on the left side, extends up into the parotid region toward the ear. The swelling is rather soft, and is closely connected with the indurated skin.

The treatment was commenced September 14, with a daily dose of 10 grams, and was continued until October 25, by which time the swelling had disappeared, but the skin was still hard and very thick. This, however, improved rapidly, and by November 12 the steer was considered cured.

Post-mortem, November 29.—No traces of the swelling left. No internal lesions. The carcass was passed as sound.

No. 546042.

Blue roan steer, hornless; received August 22.

In the sublaryngeal space on the left side is located a hard fibrous tumor the size of a cocoanut, lying loose in the connective tissue under the skin.

Treatment was commenced August 24, with a daily dose of 12 grams, and was continued until October 7, with proper intervals. The steer showed no symptoms of iodism whatever, and when treatment was stopped the tumor had only shrunk to about one-half its original size. Medicine was again administered from October 20 to October 31, during which time the tumor improved rapidly. About November 12 the tumor had disappeared, only leaving a thick induration in the skin.

Post-mortem, November 29.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 48040.

Red steer, hornless; received August 30 from Kansas City.

In the sublaryngeal space on left side is located a hard fibrous tumor the size of a child's head, lying loose in the connective tissue under the skin. In right parotid region there is a hard, flat, fibrous swelling, which is closely connected with the skin.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 1, with proper intervals. By this time the tumor under the throat had shrunk to the size of a hen's egg, while the swelling in the parotid region had become considerably reduced. About October 20 the steer was regarded as cured.

Post-mortem, November 29.—No traces of the tumors left, except a fibrous thickening in the skin in the parotid region. No internal lesions. The carcass was passed as sound.

No. 39985.

Red steer, white face, white rump and legs; received August 28.

In the loose connective tissue in the submaxillary space are located three hard fibrous tumors the size of goose eggs. The skin covering them is considerably indurated.

Treatment was commenced August 30, with a daily dose of 12 grams, and was continued until September 20, by which time the tumors had shrunk to the size of a walnut, and the induration in the skin had become thinner. October 18 the steer was considered cured.

Post-mortem, November 29.—Slight induration of skin in submaxillary space. No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 45953.

Red steer, white star, hornless; received September 5.

In left parotid region is located a hard fibrous tumor the size of a goose egg. In the sublaryngeal space on left side there is a similar one the size of a double clinched fist. The first one is closely connected with the underlying tissue, but the other one is located in the loose connective tissue under the skin.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 7, with proper intervals. By this time both tumors had shrunk considerably, and about October 28 the steer was regarded as cured, though there was still left a small deeply situated induration in the intermaxillary space.

Post-mortem, November 29.—In the intermaxillary space is located a small, flat, fibrous induration the size of a walnut, inclosing three granulomas the size of beans. The skin in left parotid region a little indurated. No internal lesions. The carcass was passed as sound.

No. 22485.

Red steer, white face, horns; received August 30, from Kansas City.

In the submaxillary space are located three hard fibrous tumors the size of goose eggs, and in the right parotid region there are two similar tumors, the lower one the same size and the upper one the size of a hen's egg. The skin covering the tumors in submaxillary space is hard and thickened.

Treatment was commenced September 1, with a daily dose of 12 grams, and continued until October 15 with proper intervals. The steer only showed slight symptoms of iodism, and the tumors shrunk rather slowly. When treatment was stopped none of the tumors were larger than a walnut. About November 10 the steer was considered cured.

Post-mortem, November 29.—In the intermaxillary space were found two small fibrous indurations, each containing a couple of small soft granulomas the size of a pea. No internal lesions. The carcass was passed as sound.

No. 39994.

Red steer, horns; received August 28.

The intermaxillary space is completely filled, from the chin to the neck, with a fibrous swelling of rather soft condition. The skin is closely connected with the underlying swelling.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until September 30, by which time the swelling had shrunk considerably. October 12 the steer was regarded as cured.

Post-mortem, November 29.—The skin that covered the swelling is fibrous indurated. No traces of actinomyces to be found. No internal lesions. The carcass was passed as sound.

No. 44531.

Red steer, horns; received September 12.

In sublaryngeal region on left side is located a hard, fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin.

Treatment was commenced October 14, with a daily dose of 12 grams, and was continued until October 15, by which time the tumor had shrunk to the size of a hen's egg. November 10 the steer was considered cured.

Post-mortem, November 29.—One of the submaxillary lymph glands was swollen to the size of a walnut, and contained an abscess the size of a bean, filled with pus containing antinomyces. Sublingual lymph gland in right side indurated. No internal lesions. The carcass was passed as sound.

No. 25386.

Red steer, white star, roan spot on right side and left thigh, hornless; received September 12, 1892.

In the loose connective tissue in the submaxillary space is located a hard fibrous tumor the size of a child's head.

Treatment was commenced September 14, with a daily dose of 15 grams, and was continued until October 12, by which time the tumor had shrunk to the size of a hen's egg. October 25 the steer was regarded as cured.

Post-mortem, November 29.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 534041.

Dark red, Hereford-crossed steer, white on hips; received August 22.

In the left parotid region is located a hard, flat, fibrous swelling, which at the lower end extends into a tumor the size of a child's head, located in the sublaryngeal space. Two inches in front of this tumor, in the submaxillary space, there is another one the size of a goose egg.

Treatment was commenced September 24, with a daily dose of 12 grams, and continued until October 1. The steer showed no symptoms of iodism, and no desquamation of the epidermis appeared under the whole treatment. Nevertheless the tumors shrunk rapidly, especially the largest one in the sublaryngeal space. October 16 the steer was regarded as cured.

Post-mortem, November 29.—In one of the submaxillary lymph glands was located a granuloma the size of a bean. The skin in the parotid region a little indurated. No internal lesions. The carcass was passed as sound.

No. 40002.

Black speckled heifer, hornless; received August 22.

In the loose connective tissue in the intermaxillary space is located a hard fibrous tumor the size of a double clinched fist.

Treatment was commenced August 25, with a daily dose of 10 grams, and was continued until September 20. By this time the tumor had almost disappeared, and by October 1 the steer was considered cured.

Post-mortem, November 29.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 131056.

Red steer, horns, white on left flank; received September 5.

In the sublaryngeal space on left side is located a hard fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin.

Treatment was commenced September 7, with a daily dose of 10 grams, and was continued until October 7, with proper intervals. By this time the tumor had shrunk to the size of a walnut. October 20 the steer was regarded as cured.

Post-mortem, November 29.—No trace of the tumor left. No internal lesions. The carcass was passed as sound.

No. 25150.

Red steer, horns; received September 5.

In the sublaryngeal space on the right side is located a hard fibrous tumor the size of a cocoanut, lying loose in the connective tissue under the skin.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued October 1. The steer showed a pronounced iodism, and the tumor shrunk rapidly. October 15 the steer was considered cured.

Post-mortem, November 29.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 25102.

Red steer, white star, horns; received September 12.

In the sublaryngeal space on the left side is located a tumor the size of a child's head. On the lower end of it, the skin is in close connection with the tumor, and out through the skin extends a round soft granuloma, about 4 inches in diameter and 1 inch thick. The surface of the granuloma is uneven and covered with pus crusts.

Treatment was commenced September 14, with a daily dose of 14 grams, and was continued until October 20, with proper intervals. The granuloma began to dry up right away, and in the third week it had shrunk to a level with the surrounding parts and was covered with epidermis. When the treatment was stopped the tumor had gone down to the size of a hen's egg, with a small white scar at the place where the granuloma was, surrounded by heavy wrinkles of skin. About November 12 the steer was regarded as cured.

Post-mortem, November 29.—Small, fibrous thickening in the skin where the tumor was. No internal lesions. The carcass was passed as sound.

No. 131035.

Red steer, horns, white star and spot on shoulder; received September 5.

In the sublaryngeal space on the left side is located a fibrous tumor the size of a child's head. It is lying loose in the connective tissue under the skin.

Treatment commenced September 7, with a daily dose of 12 grams, and was continued until October 10, with proper intervals. By this time the tumor had sunk to the size of a goose egg, and the rest disappeared without further treatment. October 25 the steer was considered cured.

Post-mortem, November 29.—One of the submaxillary lymph glands showed a fibroid degeneration, having evidently contained an actinomycoma, which under the treatment had undergone a fibrous metamorphosis. No trace of the tumor was left except a fibrous induration in the skin. No internal lesions. The carcass was passed as sound.

No. 25870.

Dark red steer, hornless; received September 12.

In the left parotid region is located an extensive, flat, hard, fibrous swelling, which below extends into a tumor filling the intermaxillary space.

Treatment was commenced September 14, with a daily dose of 15 grams, and was continued until October 15. By this time the tumor below had shrunk to about one-third its original size, while the swelling in the parotid region remained almost unchanged, though not quite as prominent as before. November 1 the treatment was commenced again, and the tumors now began to improve rapidly. November 10 treatment was discontinued, and shortly afterwards the steer was considered cured.

Post-mortem, November 29.—One of the sublaryngeal lymph glands contained an abscess the size of a hazelnut, in which was found yellow pus with actinomyces. No internal lesions. The carcass was passed as sound.

No. 39984.

Dark red, hornless steer; received August 28.

In the sublaryngeal space on the right side is located a tumor the size of a child's head. It is lying loose in the connective tissue under the skin.

Treatment was commenced September 1, with a daily dose of 10 grams, and continued until October 10. The steer showed marked symptoms of iodism and the medicine had a good effect on the tumor. When the treatment was stopped there still remained a tumor the size of a hen's egg, covered by a rather extensive hard induration in the skin. November 1 the tumor had completely disappeared, and even the induration in the skin had grown thinner.

Post-mortem, November 29.—Fibrous thickening in skin under larynx. One of the sublingual lymph glands contained a very small actinomycoma the size of a large pin head. No internal lesions. The carcass was passed as sound.

No. 48056.

Red steer, hornless, speckled body, white belly; received August 30, from Kansas City.

The intermaxillary space is completely filled with an oblong tumor, extending from the chin to the neck, and depending about 3 inches below the lower edge of the jaw. The tumor is hard and fibrous and in close connection with the skin. On the inside of the upper lip are located two soft red actinomycomas about the size of a nickel.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 7, by which time there only remained a fibrous induration in the skin under the jaw. The actinomycomas inside the lip had disappeared during the third week of the treatment. The steer was considered cured about October 15.

Post-mortem, November 29.—No traces of the disease left under the jaw or in the mouth. No internal lesions. The carcass was passed as sound.

No. 48037.

Red steer, hornless; received August 30, from Kansas City. On both cheeks outside the third molar are located hard, fibrous tumors the size of a hen's egg. They are situated in the short connective tissue under the skin, and as they are hard and can only be moved slightly, give the impression that they are bony. In the loose connective tissue in submaxillary space there is another tumor the size of a clinched fist.

The treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 1, at which time there was only a small trace left of the tumors. October 12 the steer was regarded as cured.

Post-mortem, November 29.—The sublaryngeal lymph glands were a little swollen, but no traces of the tumors were left. No internal lesions. The carcass was passed as sound.

No. 48020.

Red steer, hornless, brockled face, white on shoulder and hip; received August 20, from Kansas City.

In right parotid region is located a hard, fibrous tumor the size of a goose egg, and another one, the size of a child's head, is seen in the loose connective tissue in the sublaryngeal space.

Treatment was commenced September 1, with a daily dose of 12 grams iodide of potassium, and was continued until October 10. The steer showed very pronounced iodism, and the tumors shrunk fast. October 28 they had disappeared.

Post-mortem, November 29.—No traces of the disease left except a small callous in the skin where the tumors had been. No internal lesions. The carcass was passed as sound.

No. 533050.

Red steer, white face, shoulder, and rump; received August 22.

On the back edge of the right lower jaw is located a fluctuating tumor the size of a goose egg, and two hard, fibrous tumors of the same size in submaxillary space.

Treatment was commenced August 24, with a daily dose of 10 grams. The abscess was opened with a knife, and a few ounces of thick yellow pus evacuated. The pus did not contain actinomyces. The treatment was continued until September 20. The tumors shrunk rapidly and had disappeared about October 2.

Post-mortem, November 29, 1892.—In the submaxillary space was left a small fibrous induration containing two abscesses the size of beans. The contents of these was a thin yellow pus. The microscopic examination proved actinomyces to be present Treatment was stopped a little too soon. The carcass was passed as sound.

No. 25854.

Red hornless steer; received September 12.

In right parotid region is located a fibrous tumor the size of a goose egg, and another the size of a child's head is seen in submaxillary space. Both are hard, round, and with a smooth surface, lying loose under the skin.

Treatment was commenced September 14, with daily dose of 12 grams. Both tumors shrunk very fast, and one month later had gone down to one-third their original size. No more medicine was given, and about November 12 the steer was considered cured.

Post-mortem, November 29.—Fibrous induration of skin underneath the throat. No traces of actino. In the liver there were two small abscesses the size of hazelnuts. Microscopic examination proved that they were not caused by actinomycosis. The carcass was passed as sound.

No. 45943.

Brown hornless steer, white star; received September 5.

In left parotid region is located a hard, fibrous tumor the size of a double clinched fist, and another one the same size in submaxillary space.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 15. The tumors shrunk fast, and by November 12 no trace of them was left, not even in the skin.

Post-mortem, November 29.—Neither on the head nor in the internal organs was any of the disease found. The carcass was passed as sound.

No. 39988.

Dark red steer, hornless; received August 28.

The right lower maxilla below the first molar is swollen to the size of a double clinched fist. It is bony, hard, but the covering skin is thick and indurated, and closely attached to the underlying tissue.

Treatment was commenced August 30, with a daily dose of 12 grams, and was continued until October 20, with proper intervals. The steer showed a pronounced iodism, and the tumor shrunk a little and became bony hard.

Post-mortem, November 29.—In the indurated skin on the swelling were located a few small centers of soft tissues the size of peas. The internal tissue of the bone was rather solid, only a trifle spongy, with no traces of disease. The lymph glands on head were sound. No internal lesions. The carcass was passed as sound.

No. 39992.

Black hornless steer; August 28, 1892.

Bony swelling of right lower maxilla, similar to above No. 39988. Treatment the same.

Post-mortem, November 29.—The internal parts of the swelling were spongy, and contained several centers of soft tissue the size of hazelnuts. No pus was found. Lymph glands sound. No internal lesions. The carcass was condemned.

No. 130915.

Red white-speckled steer, white star and horns; received August 30.

All the facial bones on the right side of the head are immensely swollen from the edge of the lower eyelid down to the nose. There is hardly any fibrous covering on the bony parts, except below, where the tumor gradually goes over on the lower maxilla. On the most prominent part of the swelling is an ulcer the size of the palm of a hand, located about 4 inches below the eye. The lachrymal duct is obliterated so that the tears run down over the tumor. (See Plate VIII.)

Treatment was commenced September 1, with a daily dose of 15 grams, and continued to October 25, with proper intervals. The medicine caused well-marked symptoms of iodism, but the tumor remained almost unchanged, the fibrous swelling on the lower jaw shrinking a little. The ulcer dried up and left a small scar 1 by 2 inches. As no further improvement could be expected the treatment was stopped.

Post-mortem, November 29.—An incision through the bony swelling shows this completely filled with numerous cavities the size of peas, filled with pus and soft tissue, both containing actinomyces. No lesions in internal organs. The carcass was condemned.

No. 545524.

Red dehorned steer, white star, white on left fore knee, side, and hip; received August 16, 1892.

The left lower maxilla is immensely swollen from the mouth and backwards. On the lower part of the swelling, which occupies the whole intermaxillary space, and has a dependence of 5 to 6 inches below the original edge of the jaw, is located an ulcerating granuloma about 7 inches in diameter, protruding about 3 inches over the surroundings. The deeper parts of the swelling are hard like bone, covered with a thick layer of fibrous tissue, which around the granuloma forms a heavy swollen wall 2 to 3 inches thick. Upwards the fibrous part of the tumor extends over the upper jaw and the parotid region, gradually growing thinner up against the eye and ear. The skin covering the tumor is closely connected with it all over. The surface of the granuloma is uneven, covered with crusts, and small drops of pus constantly ooze out at many different places. The base of the granuloma is a little smaller than the circumference of it. A 2-inch deep fissure separates the edges of the granuloma from the epidermis-covered parts. The steer is constantly grinding his teeth and slabbering from the mouth. Condition rather poor. (See Plate VI.)

The treatment was commenced August 18, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The tumor apparently did not shrink much, though the fibrous parts of it, especially on the upper jaw, were reduced considerably. The granuloma dried up, but shrunk only very slowly. By November 12 there was only a scar about 5 inches in diameter left at the place where the base of the granuloma was, and the fibrous wall which surrounded it had also grown considerably thinner, but is now the most prominent part, as it has not shrunk as fast as the granuloma.

Post-mortem, November 29.—An incision through the bony tumor shows numerous alveoli filled with soft granulomatous tissue containing very little pus. Directly above the scar on the lower surface is a large granuloma the size of a goose egg. The consistence of this is not soft as usual, and contains less pus. In this actinomyces were found.

In the wall of the small intestines were located a few hard small nodules the size of millet seeds, containing a dry mass, consisting mostly of limesalts. No actinomyces were found. Other internal organs sound. The carcass was condemned.

No. 534819.

Red steer, white star, white left shoulder and rump, dehorned; received August 16.

The right lower maxilla is immensely swollen from the ramus to the angle. The swelling is bony and covered with a thick fibrous layer, which extends up over the cheek towards the eye. Underneath it occupies the whole intermaxillary space and has a dependence of 4 inches. (See Plate III.)

The treatment commenced August 18, with a daily dose of 12 grams, and was continued until September 25. The fibrous parts of the swelling had by this time shrunk considerably, leaving the tumor hard as bone. The swelling on the upper jaw had almost disappeared, only in the submaxillary space there remained a good deal of fibrous covering. The treatment was then continued for three weeks more without much improvement.

Post-mortem, November 29.—The fibrous tissue covering the lower part of the bony swelling contained a few deposits of soft tissue, while the bony swelling contained several cavities filled with the same and a few filled with pus. No internal lesions. The carcass was condemned.

No. 48087.

Red steer, white star and shoulder, hornless; received August 30 from Kansas City.

The right ramus of the lower maxilla is swollen to an enormous size. The swelling fills the entire intermaxillary space from the chin to the neck and extends up over the right cheek toward the eye. The deeper parts of the swelling are hard, covered with a thick layer of fibrous tissue, which on the lower part of the swelling is 4 or 5 inches thick. There is located at this point an ulcerating granuloma 6 to 8 inches in diameter and protruding 3 to 4 inches over the swollen margin of the surroundings. The surface of the granuloma is uneven, partly raw and bleeding, and partly covered with crusts of pus, which is constantly discharged through numerous minute openings on the surface. The ulcer has a very fetid odor. The skin covering the tumefaction is closely attached to the underlying tissue. The entire swelling was fully the size of a gallon jug.

Treatment was commenced September 1, with a daily dose of 15 grams, and was continued until November 1, with proper intervals, two of which extended over a week each. The steer showed a pronounced iodism, and, though the manure constantly was rather hard, the steer did not lose in condition. The ulcerating surface of the granuloma soon began to dry up and no more pus was discharged. The swollen indurated margins shrunk and contracted considerably, and by this contraction the whole granuloma, which then had shrunk to the size of a clinched fist, was expelled, leaving a dry scar. The softer parts of the swelling, especially in the submaxillary space and the parts extending up over the cheek, disappeared almost entirely, leaving the bony part closely covered by the indurated skin.

Post-mortem, November 29.—The skin covering the swelling is indurated and about three-fourths of an inch thick. On the lower part of the tumefaction is seen a white contracted cicatrix 3 to 4 inches in diameter, and in the thin fibrous covering of the bony swelling were a few small centers of reddish granulomatous tissue. A section through the bone shows this spongy and filled with numerous centers and pockets containing yellow pus of a rather slimy character, and several cavities filled with soft red tissue interrupted by the characteristic small yellow spots. All the surrounding lymph glands were perfectly sound and no lesions were found in the internal organs. The carcass, though it was in splendid condition, was condemned.

No. 48247.

White roan steer, horns; received August 30 from Kansas City.

Immense swelling of right lower maxilla with ulcerating granuloma. Case similar to above number (48087).

Post-mortem, November 29.—The granuloma had not disappeared altogether. It shrunk to the size of a hen's egg, and was rather hard and dry. The fibrous tissue covering the bony swelling contained several small centers of soft tissue. An incision through the bony swelling shows this to be spongy, with numerous pockets and cavities filled with soft red tissue and pus. The lymph glands on head were sound. The carcass was condemned.

No. 534031.

White steer, dehorned; received August 22.

The left side of the face, from the eye down to the nose, is immensely swollen. The swelling is of a bony consistency, the covering skin only a little indurated. On the most prominent part, 3 inches below the eye, there is an ulcer 4 by 5 inches in diameter and only protruding a little over the surrounding parts. On the surface of the ulcer, which is covered by dry pus crusts, 3 fistulas open out, constantly discharging a little yellow inodorous pus.

Treatment was commenced August 24, with a daily dose of 15 grams, and was continued until October 7, with proper intervals. By this time the fibrous part of the swelling had shrunk considerably, leaving the rest hard like bone. The ulcer had healed up, but one of the fistulas was still discharging a little pus. Medicine was again administered for two weeks without any noticeable improvement as to the size of the swelling, but no more pus was discharged from the fistula, which shortly afterward healed up. The steer showed no symtoms of iodism during the entire treatment.

Post-mortem, November 29.—The bony swelling was spongy, but contained no pus and only a few centers of soft tissue. Two cords of white connective tissue extended from the contracted cicatrices on the surface toward the deeper parts. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 39989.

Red hornless steer, white star, white spot on right hip and left flank; received August 28.

The right side of the lower maxilla is enormously swollen. The deeper parts of the tumefaction are of a bony consistency, but are covered with a thick layer of fibrous tissue, which on the lower part is about three inches thick and is closely attached to the skin. At this place there is an ulcerating granuloma, 5 to 7 inches in diameter, protruding 3 to 4 inches over the thick swollen margins of the surrounding parts. (See No. 545524, on Plate VI.)

Treatment was commenced August 30, with a daily dose of 15 grams, and was continued until October 20, with proper intervals. The steer showed a pronounced iodism and the granuloma dried up and shrunk rapidly. When the treatment was stopped there was only left a contracted scar; the fibrous parts of the swelling had shrunk considerably, and afterward continued to shrink.

Post-mortem, November 29.—The bony swelling is covered by a thin layer of fibrous tissue, which on the lower part contains a few centers of soft red tissue, ranging in size from a pea to a bean. The internal tissues of the bone are spongy, with several pockets filled with soft tissue, but none filled with pus. The surrounding lymph glands are all sound. No internal lesions. The carcass was condemned.

No. 48159.

Black steer, white star, hornless; received August 30 from Kansas City.

Immense fibrous bony swelling of left lower maxilla, with ulcerating granuloma 6 to 8 inches in diameter. (See No. 545525, on Plate VI.)

Treatment was commenced September 1, with a daily dose of 15 grams, and was continued until November 1, with proper intervals. Though the steer showed a pronounced iodism, the tumor showed no tendency to heal up or shrink; in fact, the large and frequent doses of medicine had very little effect on it. The granuloma remained unchanged in size and continued to discharge drops of pus through minute openings in the surface. The fibrous parts of the tumefaction shrunk almost entirely, making the granuloma appear about twice as large as it was originally.

Post-mortem, November 29.—An incision through the granuloma showed this to consist of very soft red tissue, with numerous pus foci, ranging in size from a pin head to a pea. The internal part of the bony swelling was spongy, containing numerous centers of soft red tissue, the largest being about the size of a walnut. The lymph glands on head were sound. No internal lesion. The carcass was condemned.

No. 130988.

Red steer, hornless, white spot on right shoulder; received September 5, 1892.

In sublaryngeal space on left side is located a fibrous tumor the size of a cocoanut. The tumor was slightly fluctuating, and was opened with a knife. It inclosed a deeply situated abscess, which contained from 1 to 3 ounces of good yellow pus.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 10, by which time the tumor had disappeared, only leaving a fibrous thickening in the skin. About October 20 the steer was considered cured.

Post-mortem, November 29.—No traces of the tumor left, except a slight induration of the skin. In the upper part of the right lung was located a tumor the size of a clinched fist. In the left lung in the same place was a tumor the size of a walnut. Both tumors consisted of fibrous tissue, and contained several cavities filled with pus and granulomatous tissue. The microscopic examination proved them to be actinomycomas. The carcass was condemned.

No. 47067.

Red dehorned steer; received August 16.

On the left cheek are located seven hard fibrous tumors, ranging in size from a hazelnut to a walnut. They are situated in the short connective tissue under the skin, and can only be moved slightly. In the submaxillary space is located another one the size of a double clinched fist.

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until October 1, with proper intervals. By this time the small tumors in the cheek had disappeared, each leaving a small fibrous thickening in the skin. The tumor underneath had shrunk to the size of a hen's egg. About October 20 the steer was considered cured.

Post-mortem, November 29.—No traces of the tumors left, except a slight induration in the skin under the throat. In the upper part of the left lung were found three tumors about the size of a walnut. In the right lung a similar one the size of a hazelnut. All of them contained soft granulomatous tissue and pus. The microscopic examination proved the pus to contain actinomyces. The carcass was condemned.

No. 130916.

Red steer, white face, horns; received August 30 from Kansas City.

Immense fibrous bony swelling of left lower maxilla, with ulcerating granuloma 6 to 8 inches in diameter. (See No. 545524, on Plate VI.)

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The steer showed symptoms of iodism. The granuloma shrunk considerably, but did not dry up. The fibrous parts of the swelling were reduced.

Post-mortem, November 29.—The surface of the external granuloma is ulcerated. An incision through it shows that it consists of soft red tissue, with numerous pus foci the size of small peas. The fibrous covering on the bony swelling contained traces of soft tissue. The internal parts of the bone were spongy, with a few centers of soft tissue the size of hazelnuts. In the wall of the small intestines were located a few small hard nodules, containing a green colored detritus mass, consisting mostly of lime salts. The microscopic examination proved them not to be actinomycotic lesions. No other lesions internally. The carcass was condemned.

No. 44007.

Red roan dehorned steer, white on left shoulder and brisket; received August 16.

Immense fibrous, bony swelling of right lower maxilla, with ulcerating granuloma 6 to 7 inches in diameter. (See No. 545524, on Plate VI.)

Treatment was commenced August 18, with a daily dose of 12 grams, and was continued until October 10, with proper intervals. The steer showed pronounced iodism. The granuloma dried up, but only shrunk a little. The fibrous parts of the swelling were reduced somewhat in size. Medicine was again administered from October 20 to November 1, by which time the granuloma had shrunk to the size of a hen's egg, and the fibrous parts had disappeared almost entirely.

Post-mortem, November 29.—The external granuloma, which is about the size of a walnut, is rather hard, having a dry surface. It contains no pus foci, but extends up into a cavity in the bony swelling the size of a goose egg. Under the peritoneal covering on the small intestines were located a few small hard nodules, containing a greenish detritus mass with considerable lime salts in it. No actinomyces was found by the microscopical examination. On the surface of the liver was located an abscess the size of a hazelnut, filled with yellow pus. This also was free from the actinomyces. The carcass was condemned.

No. 45902.

Red steer, dehorned; received September 5, 1892.

The right ramus of the lower maxilla below the first molar is swollen to the size of a double clinched fist. The skin covering it is thickened and indurated, being about 1 inch thick on the lower part.

The treatment was commenced September 7, with a daily dose of 12 grams, and was continued until November 1. The steer showed a pronounced iodism, but the tumor shrunk only very little.

Post-mortem, November 29.—The induration covering the bony swelling contains a few centers of soft granulomatous tissue the size of hazelnuts. The internal parts of the bone were a little spongy, but contained no pus cavities. No lesions in the lymphatic glands and no internal lesions. The carcass was condemned.

No. 48042.

Red steer, partly dehorned; received August 30 from Kansas City.

On the right side of the face, 1 inch below the eye, is located a bony hard swelling the size of a clinched fist. The skin that covers the swelling is thick and indurated.

Treatment was commenced September 1 with a daily dose of 12 grams and continued until October 30, with proper intervals. The tumor remained almost unchanged, only the induration in the skin becoming thinner.

Post-mortem, November 29.—The internal parts of the bony swelling were very spongy, with several pockets filled with soft granulomatous tissue, but without any pus. A cord of white connective tissue extended from the center of the swelling down to the socket of the third molar in the upper jaw, which was loose. The lymph glands on the head were all sound. No internal lesions. The carcass was condemned.

No. 39978.

Dark red steer, horns; received August 28.

On the right side of the face a little below the eye there is a flat bony swelling as large as the palm of a hand, and protruding about 1 inch. The skin covering the swelling is a little indurated. In the submaxillary space is located a hard fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin.

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 15, with proper intervals. The bony swelling remained unchanged, while the tumor in submaxillary space completely disappeared.

Post-mortem, November 29.—The bony swelling contained a few centers with soft tissue, but no pus. No traces of the other tumor left. Lymph glands on head sound. In the left lung was a fibrous induration the size of a hen's egg, containing several small pockets filled with pus and soft tissue. Microscopical examination proved them to be actinomycomas. The carcass was condemned.

No. 48510.

Red steer, hornless, white star; received September 5.

Immense bony swelling of lower maxilla on right side, with large ulcerating granuloma on lower end. Case smilar to No. 48087.

Treatment was commenced September 7, with a daily dose of 15 grams, and was continued until November 1, with proper intervals. The granuloma dried up and disappeared altogether, only leaving a large contracted cicatrix. The thick indurations which covered the bony swelling were reduced to a thin layer of connective tissue half an inch thick.

Post-mortem, November 29.—An incision through the bony part of the swelling shows this to be spongy. In the lower part of it, just inside the scar left by the granuloma, there was a large sinus the size of a hen's egg, and filled with the characteristic soft red tissue with the small yellow spots in. No pus could be squeezed out of the cut surface. The rest of the swelling contained neither pus nor soft tissue. No internal lesions. Lymph glands on head sound. The carcass was condemned.

No. 48155.

Black steer, hornless, spotted, white star; received August 30 from Kansas City.

All the left side of the face from the eye down to the nose is immensely swollen. The swelling is hard as bone and the covering skin is thick and indurated. Two or three fistulas open out on the surface, discharging yellow pus containing actinomyces.

Treatment was commenced September 1, with a daily dose of 15 grams, and was continued until October 20, with proper intervals. By this time the tumor had shrunk to its capacity, the fistulas had healed up, each leaving a small contracted scar which remained closed until the steer was killed six weeks later.

Post-mortem, November 29.—The skin is closely attached to the bony swelling. An incision through the bony swelling shows the internal tissue spongy, but containing neither pus nor soft tissue. The lymph glands on the head were sound and no internal lesions found. The carcass was condemned.

No. 39972.

Red steer, horns; received August 28, 1892; symptoms and treatment exactly like above number (48155).

Post-mortem, November 29.—The internal spongy part of the bony swelling contained a pocket the size of a robin's egg filled with pus. In the fibrous covering of the bone there were a few centers of soft tissue the size of beans. Lymph glands on head sound. No internal lesions. The carcass was condemned.

No 39953.

Roan steer, horns; received August 28. On the right side of the face, 2 inches below the eye, there is a hard bony swelling the size of a goose egg. In the loose connective tissue in the submaxillary space is located a hard fibrous tumor as large as a clinched fist.

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 7, with proper intervals. By this time the tumor in the submaxillary space had completely disappeared, while the bony swelling remained almost unchanged.

Post-mortem, November 29.—No traces of the fibrous tumor left. Surrounding lymph glands all sound. An incision through the bony swelling proved it to be spongy with numerous centers of soft tissue. No internal lesions. The carcass was condemned.

No. 39955.

White steer, rudiments of horns; received August 28.

Large fibrous bony swelling of left lower jaw, with ulcerating granuloma 4 to 5 inches in diameter. (See No. 545524, on Plate VI.) On the right side of the face a couple of inches below the eye there is a small, flat, bony swelling.

Treatment was commenced August 30, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The fibrous part of the tumefaction shrunk almost entirely and the granuloma dried up and disappeared, leaving a contracted scar not larger than a silver dollar. The steer showed pronounced iodism.

Post-mortem, November 29.—No traces of actino in the thin fibrous cover of the bony swelling. This one, however, contained several cavities filled with soft tissue and pus. The small bony swelling on the upper jaw was solid and contained no traces of the disease. The lymph glands on the head were sound. No internal lesion s. The carcass was condemned.

No. 531593.

Spotted brown steer, dehorned, white star; received August 22.

Immense fibrous bony swelling of left lower maxilla, with ulcerating granuloma, 5 to 7 inches in diameter. (Case similar to that shown in No. 545524, on Plate VI.)

Treatment was commenced August 24, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The steer showed plain symptoms of iodism, and the fibrous parts of the tumor shrunk considerably. The granuloma did not dry up, but a piece of it, about one-third, was expelled by the shrinking of the fibrous surroundings. Medicine was again administered for two weeks, but without any noticeable improvement.

Post-mortem, November 29.—The thick induration in the skin on the bony swelling contained several centers of soft tissue the size of hazelnuts. The bony part of the swelling was spongy, with numerous pockets, filled with pus and soft tissue. The inside of the right lower maxilla was slightly affected in the same way. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 545543.

Red steer, hornless; received August 16.

Immense fibrous bony swelling of right lower maxilla, with ulcerating granuloma 5 to 6 inches in diameter. (Case similar to that shown in No. 545524, on Plate VI.)

Treatment was commenced August 18, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. By this time the granuloma had dried up and disappeared, leaving a white contracted cicatrix. The fibrous parts of the swelling had also shrunk considerably. The steer showed pronounced iodism.

Post-mortem, November 29.—The bony swelling is covered by a thin layer of fibrous tissue. The internal tissue of the bone is spongy, with one large cavity the size of a clinched fist filled with soft tissue which, on the lower part, is covered by the scar left from the external granuloma. No pus can be squeezed out of the cut surface. The lymph glands on the head were all sound. No internal lesions. The carcass was condemned.

No. 45591.

Red steer, rudiments of horns; received August 30, from Kansas City.

Swelling of facial bones, left side from eye to nose, with ulcer size of the palm of a hand. (See No. 130915, on Plate VIII.)

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The steer showed pronounced iodism. The ulcer dried up, only leaving a small cicatrix. The fibrous parts of the swelling shrunk almost completely, leaving the bony part covered by the slightly indurated skin.

Post-mortem, November 29.—The bony swelling was spongy and contained several centers of soft tissue, but no pus. The lymph glands on head were sound. Small actinomycotic tumor in the lung. The carcass was condemned.

No. 39951.

Red steer, large horns, white stripe across forehead; received August 28, 1892.

Immense fibrous bony swelling of right lower maxilla. (See No. 545524, on Plate VI.) Ulcerating granuloma, 4 to 5 inches in diameter.

Treatment was commenced August 30, with a daily dose of 15 grams, and was continued until October 25, with proper intervals. The steer showed pronounced iodism, and the fibrous parts of the tumor shrunk considerably. The granuloma dried up and shrunk to the size of a walnut.

Post-mortem, November 29.—The fibrous part of the swelling contained several centers of soft tissue, especially in the lower part around the scar left from the granuloma. The remaining part of this was rather hard and dry. The internal tissue of the bone was spongy, with a few centers of soft tissue and pockets filled with pus. Just inside the granuloma was a large cavity filled with soft tissue. The lymph glands on head were sound. No internal lesions. The carcass was condemned.

No. 39981.

Speckled steer, dehorned; received August 28.

Immense fibrous bony swelling of right lower jaw, with ulcerating granuloma. (Case similar to that shown in No. 545524, on Plate VI.)

Treatment was commenced August 30, with a daily dose of 15 grams, and was continued until November 1, with proper intervals. Though the steer showed a fair degree of iodism, the effect of the medicine on the tumefaction was scarcely noticeable. The granuloma only dried up around the edges, but continued to ulcerate in the central part of the surface with a very fetid odor. The surrounding fibrous swelling shrunk somewhat, which made the granuloma appear more prominent than it did originally. In spite of the large and frequent doses of medicine no further improvement was obtained.

Post-mortem, November 29.—The head had been removed by the butchers before examination. No internal lesions. The carcass was condemned.

No. 39966.

Light-red steer, hornless; received August 28.

On the right lower maxilla, below the third molar, is located a hard bony swelling the size of a goose egg. The skin covering the swelling is thick and indurated, and closely attached to the underlying tissue.

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 15, with proper intervals. The first two weeks the swelling increased considerably in size, and became a trifle larger than a clinched fist. The dose was then increased to 12 grams, and later on to 15 grams, but in spite of this the steer, which weighed about 1,100 pounds, only showed obscure symptoms of iodism. The growth of the tumor was checked, but it did not shrink any.

Post-mortem, November 29.—The head of the steer had been removed by the butchers before it was examined. No internal lesions. The carcass was condemned.

No. 59805.

Brindle steer, horns; received August 30, from Kansas City.

Extensive swelling of facial bones on right side. (Case similar to that shown in No. 130915, on Plate VIII, but without granuloma.)

Treatment was commenced September 1, with a daily dose of 15 grams, and was continued until November 1, with proper intervals. Steer showed a pronounced iodism, but the tumor only shrunk very little.

Post-mortem, November 29.—The skin covering the bony swelling was thick and indurated. The internal tissue of the tumefaction spongy, with numerous centers of soft tissue and pockets filled with pus. Lymph glands on head sound. No internal lesions. The carcass was condemned.

No. 39959.

Red steer, hornless, brindle head and neck; received August 28.

Immense fibrous bony swelling of left lower jaw. Ulcerating granuloma 6 to 7 inches in diameter, and 2 to 3 inches thick. (Case similar to that shown in No. 545524, on Plate VI.)

Treatment was commenced August 30, with a daily dose of 15 grams, and was continued until October 25, with proper intervals. The steer showed a pronounced iodism. The fibrous part of the tumor shrunk almost entirely. Granuloma dried up and was drawn in. By November 12 it had disappeared, only leaving a large white contracted cicatrix.

Post-mortem, November 29.—The fibrous parts of the swelling around the cicatrix contained a few centers of soft tissue the size of hazelnuts. The bony swelling was spongy with a few pockets containing yellow inodorous pus. Surrounding lymph glands were sound. No internal lesions. The carcass was condemned.

No. 48043.

Red steer, white star, hornless; received August 30, from Kansas City.

Bony swelling of the left side of the face, from the eye to the nose. (Case similar to that shown in No. 130915, on Plate VIII.)

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The steer showed the usual symptoms of iodism. The tumor remained unchanged in size, only the thick indurated skin covering it became a trifle thinner.

Post-mortem, November 29.—No traces of actino in the indurated skin. The internal tissue of the bony swelling was spongy, and contained a few centers of soft tissue the size of hazelnuts. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 45887.

Red steer, hornless, white star; received September 5.

Immense fibrous bony swelling of left lower maxilla, with ulcerating granuloma 6 to 7 inches in diameter. (See No. 545524, on Plate VI.)

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The steer showed a pronounced iodism and the granuloma soon began to dry up and shrink, and finally disappeared entirely. The thick fibrous induration in the skin was reduced considerably.

Post-mortem, November 29.—The fibrous tissue on the lower part of the tumefaction inclosed a few small centers of soft tissue. The internal parts of the bony swelling were spongy, with several pockets and centers of pus and soft tissue. One of these just inside the scar left by the external granuloma was the size of a hen's egg. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 545544.

Dark red steer, white face and rump; received August 16.

Large fibrous bony swelling on left lower maxilla with ulcerating granuloma 4 to 5 inches in diameter. (See No. 545524, on Plate VI.)

Treatment was commenced August 18, with a daily dose of 12 grams, and was continued until October 1, with proper intervals. The steer showed no symptoms of iodism, and the tumor improved only slowly. The granuloma dried up and shrunk slightly, and so did the fibrous parts of the tumefaction. Medicine was again administered from October 15 to October 30, by which time the granuloma had disappeared and the swelling had been reduced considerably.

Post-mortem, November 29.—The internal parts of the swelling were spongy, and contained several cavities filled with soft tissue, one of which, just inside the cicatrix left by the external granuloma, was the size of a walnut. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 39983.

Red steer, white star, hornless, white spot on shoulder; received August 28, 1892.

Large fibrous bony swelling of right lower maxilla with ulcerating granuloma 4 to 5 inches in diameter. (See No. 545524, on Plate VI.)

Treatment was commenced August 30, with a daily dose of 12 grams, and was continued until October 25, with proper intervals. The steer showed a pronounced iodism; the granuloma dried up and disappeared, and the fibrous part of the swelling was reduced considerably.

Post-mortem, November 29.—The dense fibrous tissue surrounding the scar left by the granuloma contained a few centers of soft tissue; the internal tissues of the bony swelling were spongy, with several pockets filled with soft tissue, one of them, corresponding to the cicatrix, being the size of a hen's egg. No internal lesions. The carcass was condemned.

No. 131026.

Light roan steer, horns; received September 5.

No. 131030.

Speckled steer, red head and neck; received September 5.

Large, fibrous, bony swelling of right lower maxilla with ulcerating granuloma 2 to 3 inches in diameter. Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 28, with proper intervals. Both steers showed a pronounced iodism. The granuloma dried up and disappeared, and the fibrous parts shrunk considerably.

Post-mortem, November 29.—No. 131026. The fibrous covering on the bony swelling showed no traces of actinomycosis. The internal tissue of the bone was spongy, and contained only a few small centers filled with soft tissue. The lymph glands on the head were sound. No internal lesions. As the steer was in a very poor condition the carcass was condemned.

No. 131030. The fibrous part of the swelling contained several centers of soft tissue. The internal parts of the bone were spongy, and contained several large pockets with soft tissue, especially just inside the scar left by the external granuloma. No internal lesions. The carcass was condemned.

Though both steers showed exactly the same external lesions, and received exactly the same treatment as to dose of medicine and length of time administered, and though they both apparently improved equally, the post-mortem examination showed that the medicine had had a much stronger effect on the internal parts of the tumefaction on the first one than on the other.

No. 130905.

Red speckled steer, horns; received August 30 from Kansas City.

Fibrous bony swelling of the left side of the face from eye to nose. (See No. 130915, on Plate VIII.)

Treatment commenced September 1, with a daily dose of 12 grams, and was continued until October 25, with proper intervals.

The steer showed a pronounced iodism, and the fibrous parts of the tumefaction shrunk considerably, leaving the bony swelling covered by the slightly indurated skin.

Post-mortem, November 29.—The thin fibrous covering of the bony swelling contained a few small centers of soft tissue. The internal tissue of the bone was spongy, and contained several pockets filled with soft tissue and pus. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 48089.

Red steer, hornless; received August 30 from Kansas City.

Immense swelling of the facial bones on right side from eye to nose. The covering skin is very thick and indurated. On the most prominent part, 3 inches below the eye, is located an ulcer 4 to 5 inches in diameter. (Case similar to that shown in No. 130915, on Plate VIII.)

Treatment was commenced September 1, with a daily dose of 15 grams, and was continued until October 25, with proper intervals. The steer showed a pronounced iodism and the fibrous parts of the swelling were reduced considerably, while the ulcer dried up and became covered with epidermis, leaving three small fistulous openings, which soon afterwards closed up.

Post-mortem, November 29.—Slight traces of soft tissue centers left in the indurated skin. The internal tissues of the bony swelling were spongy, but contained only a very few cavities, filled with soft tissue. The lymph glands on head were sound. No internal lesions. The carcass was condemned.

No. 545764.

Red steer, white star, small horns; received August 16, 1892.

The right lower maxilla is swollen from the mouth to the neck. The swelling is hard as bone near the mouth, while the posterior parts are soft.

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until September 12, when the soft parts of the swelling had disappeared, leaving a hard, bony tumor the size of a clinched fist on the lower edge of the under jaw near the chin. (See Plate II.)

The treatment was again commenced October 10, and continued until November 15, with proper intervals, but apparently without further improvement in the size of the tumor. The steer being in a rather poor condition was not killed with the first lot slaughtered on November 29.

Post-mortem, January 27, 1893.—In right lower maxilla is a bony swelling the size of a goose egg. A section through this shows it to consist of compact bone, which, around the dental canal, is spongy, and contained a little pus. The fifth molar was decayed. No internal lesions. The carcass was passed as sound.

No. 130926.

White speckled cow, short horns; received September 12, 1892.

In the sublaryngeal space, on the right side, is located a hard, fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin.

Treatment was commenced September 14, with a daily dose of 10 grams, and was continued until October 20, when the tumor had shrunk to the size of a hen's egg.

Medicine was again administered from November 13 till January 25, with one dose twice a week, which removed the last traces of the tumor.

Post-mortem, January 27, 1893.—No traces of the tumor left. A few small hard nodules in the wall of the small intestines. Lungs and liver sound. The carcass was passed as sound.

No. 545750.

White speckled steer, with horns; received August 16, 1892.

The right upper maxilla a little below the eye is swollen considerably. The covering layer of the swelling is fibrous, the deeper parts bony. In sublingual space is located a hard, fibrous tumor the size of a clinched fist.

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until October 2, at proper intervals. By this time the tumor in sublingual space had disappeared, while the other one had grown considerably smaller. From November 1 until January 25 medicine was given about twice a week, only reducing the swelling a little.

Post-mortem, January 27, 1893.—No traces of actino in the fibrous covering on the bony swelling. This, however, is completely filled with actinomycotic new formations, which extend into the maxillary sinus, and from here into the nasal fossa, where it may be felt by inserting a finger through the nostril.

Pleuritic adhesions in right lung. Internal organs sound. The carcass was condemned.

No. 48071.

Red spotted steer, hornless; received August 30, 1892, from Kansas City.

In right parotid region is located a hard, fibrous tumor the size of a goose egg, and a similar one is seen in sublaryngeal region on same side.

Treatment was commenced September 1, with a daily dose of 10 grams, and was continued until October 10, with proper intervals, by which time the steer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of the tumors left. A few small hard nodules in the wall of the small intestines. Anterior lobes of both lungs adherent to pericardium. The carcass was passed as sound.

No. 480496.

Dark red steer, dehorned; received August 16, 1892.

On both cheeks are located four to five small hard tumors the size of walnuts, and in sublaryngeal space one the size of a double clinched fist.

Treatment was commenced August 18, with a daily dose of 10 grams, and was continued until October 7, with proper intervals, by which time all the smaller tumors had disappeared and the largest one had shrunk to the size of a hen's egg. Medicine was again administered from November 1 to November 20, and soon afterwards the steer was cured.

Post-mortem, January 27, 1893.—No traces of the tumors left. A few small nodules in the wall of the small intestines. Other internal organs sound. The carcass was passed as sound.

No. 6.

No tag. Dark-red steer with horns, white belly, white spot on flank.

The steer has been under treatment for the last three months, though not steadily.

It had a fibrous tumor under the throat as big as a child's head.

At the post-mortem examination on January 27, 1893, no traces of the disease were found, and the carcass was passed as sound.

No. 25875.

White steer, hornless; received September 12, 1892.

In left parotid and sublaryngeal region is located a fibrous tumor the size of a child's head. The covering skin is connected with the tumor.

Treatment was commenced September 14, with a daily dose of 12 grams, and was continued until October 20, when the tumor had shrunk to the size of a goose egg.

From November 20 to January 25 medicine was again administered. The steer showed a pronounced iodism under the whole treatment.

Post-mortem, January 27, 1893.—No traces of the tumor left, except a fibrous induration in the skin where the tumor had be enlocated. No internal lesions. The carcass was passed as sound.

No. 59137.

Red Hereford steer, white head and shoulder; received August 28, 1892.

In left parotid region are located two tumors, the size of a hen's egg. Under the throat a similar one, the size of a double-clinched fist.

Treatment was commenced August 30 with a daily dose of 12 grams, and was continued until October 25, when all three tumors disappeared, with the exception of a little induration in the skin.

Post-mortem, January 27, 1893.—Submaxillary glands a little swollen, but sound. The skin in parotid region and under the throat fibrous and indurated. No internal lesions. The carcass was passed as sound.

No. 45957.

Red steer, white breast and back; received September 5, 1892.

In sublaryngeal space on right side is located a fibrous tumor the size of a child's head.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until October 10, with proper intervals. By this time an abscess had formed, which was opened, and 4 to 5 ounces of good yellow pus evacuated. The tumor had shrunk considerably in size. Medicine was again administered from November 15 till January 20. The steer showed pronounced iodism, and the tumor shrunk rapidly.

Post-mortem, January 27, 1893.—No traces of the tumor left except a 1-inch thick fibrous induration in the skin. No internal lesions. The carcass was passed as sound.

No. 130914.

Red steer, white face and belly, with horns; received August 30, from Kansas City.

In sublaryngeal space is located a hard, fibrous tumor the size of a child's head. Inside the lips are located several small granulomas.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 15, with proper intervals. The granulomas in the mouth disappeared after two weeks' treatment, and the tumor under the throat shrunk rapidly, the steer showing a pronounced iodism. Medicine was again administered from November 1 until November 20, when the steer was regarded as cured, though it was in a rather poor condition.

Post-mortem, January 27, 1893.—Postpharyngeal glands indurated. No internal lesions. The carcass was passed as sound.

No. 533770.

Red steer, white forehead and jaws, hornless; received August 22, 1892.

In right parotid region, just below the ear, is located a fibrous tumor the size of a clinched fist. In sublaryngeal space a similar tumor the size of a child's head.

Treatment was commenced August 24, with a daily dose of 12 grams, and was continued until October 20, with proper intervals. By this time the tumor in parotid region had disappeared, and the other one shrunk to the size of a goose egg. Medicine was again administered from November 9 until January 10, when this tumor had almost disappeared.

Post-mortem, January 27, 1893.—No traces of the tumor left except a fibrous induration in the skin. No internal lesions. The carcass was passed as sound.

No. 39995.

Roan steer, hornless; received August 28, 1892.

In sublaryngeal region is located a hard, fibrous tumor the size of a cocoanut.

Treatment was commenced on August 30, with a daily dose of 12 grams, and continued until October 20. The steer showed no symptoms of iodism, and the tumor remained almost unchanged. Treatment was continued from November 10 until January 20, but the tumor only shrunk very little.

Post-mortem, January 27, 1893.—Under the throat is located a fibrous tumor the size of a child's head, containing several large centers of soft tissue and pus. The lymph glands on head sound. In the walls of the small intestines were located a few small nodules. The carcass was condemned.

No. 39969.

Strawberry roan steer, dehorned; received August 28, 1892.

In left sublaryngeal space is located a fibrous tumor the size of a double clinched fist, and on the middle of the left cheek is a similar one the size of a goose egg.

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 15, with proper intervals. By this time the tumor on the cheek had almost disappeared, and the other one grown considerably smaller. Medicine was again administered from November 12 until January 15, when the steer was regarded as cured. The steer showed only slight symptoms of iodism.

Post-mortem, January 27, 1893.—No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 545511.

Light-red steer, dehorned; received August 16, 1892.

In sublaryngeal space, on left side, is located a tumor the size of a child's head. On the lower part of the tumor extends through the skin an ulcerating granuloma the size of a hen's egg.

Treatment was commenced August 18, with a daily dose of 12 grams, and was continued until October 7, with proper intervals. The steer showed no symptoms of iodism, and the tumor shrunk only slowly, while the granuloma showed no inclination to dry up. From November 9 the treatment was again commenced, and this time with better effect. The dose was increased to 15 grams. The tumor shrunk completely and the granuloma dried up. January 5 the treatment was discontinued, and two weeks later the steer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of tumor left, except a white cicatrix in the skin. Left postpharyngeal lymph gland considerably swollen, containing several small pus centers. No internal lesions. The carcass was passed as sound.

No. 130921.

Red steer, hornless; received September 5, 1892.

In right parotid region is located a fibrous tumor the size of a double clinched fist, a similar one under the throat the size of a child's head, and another in left parotid region, the size of a goose egg.

Treatment was commenced September 7, with a daily dose of 12 grams, and was continued until November 10, with proper intervals. The steer showed a pronounced iodism, and the tumors shrunk rapidly. When the treatment was discontinued there only remained slight traces of the tumors, which disappeared soon afterward.

Post-mortem, January 27, 1893.—No traces of tumors left. No internal lesions. The carcass was passed as sound.

No. 39965.

Red steer, white face and stomach; received August 28, 1892.

In right parotid region is located a hard, fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin.

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 20, with proper intervals. By this time the tumor had almost disappeared, the steer showing a pronounced iodism. November 17 a new tumor began to form on the opposite side; and medicine was again administered until December 20, when the steer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 25364.

Dark-red steer, horns; received September 12, 1892.

Under the throat on left side is located a hard fibrous tumor, the size of a big child's head, lying loose in the connective tissue under the skin.

Treatment was commenced September 14, with a daily dose of 12 grams, and was continued until October 20. The steer showed only slight symptoms of iodism and the tumor shrank slowly. November 10 the tumor had decreased to the size of a clinched fist, and medicine was again administered until December 12, when only a small bunch was left under the skin, which disappeared soon afterward.

Post-mortem, January 27, 1893.—No traces of the tumor left except a thick fibrous induration in the skin. No internal lesions. The carcass was passed as sound.

No. 131004.

Dark-red steer, roan face, hornless; received September 5, 1892.

In sublaryngeal space is located a tumor the size of a child's head. On the lower end of this there is a granuloma about 2 inches in diameter.

Treatment was commenced on September 7, with a daily dose of 12 grams, and was continued until October 7, when the granuloma had dried up and the tumor shrunk to the size of a goose egg. November 5 the granuloma began to grow again, and medicine was administered until December 12, when the steer was regarded as cured. The animal showed a pronounced iodism under the treatment.

Post-mortem, January 27, 1893.—No traces of tumor left except a white contracted cicatrix on the slightly indurated skin. No internal lesions. The carcass was passed as sound.

No. 19.

No tag. Red steer, horns.

On post-mortem examination, January 27, 1893, there was found no trace of actinomycosis, except a fibrous induration in the skin under the throat.

No. 20.

No tag. Same as above.

Both carcasses were passed as sound.

No. 53488.

Dark-red steer, white forehead, hornless; received August 16, 1892.

In left parotid region, just below the ear, is located a hard, fibrous tumor the size of a hen's egg, and below this one, in the sublaryngeal region, another the size of a child's head.

Treatment commenced August 18, with a daily dose of 10 grams, and was continued until October 23, with proper intervals. The steer showed a slight iodism, and when the treatment was stopped the smaller tumor had disappeared and the larger one shrunk to the size of a walnut, but covered by a very thick, fibrous induration in the skin. Medicine was therefore commenced again on November 10 and continued until December 20, with two doses per week. By this time the steer was regarded as cured.

Post-mortem, January 27, 1893.—The skin in the parotid region slightly indurated. No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 47988.

Red steer, hornless; received August 30, from Kansas City.

Flat, fibrous, bony swelling on left upper maxilla, with a granulating ulcer 3 inches in diameter.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 20, when the fibrous parts of the swelling had disappeared and the ulcer dried up, leaving only a small white cicatrix. November 10 this broke open again, and medicine was again administered for four weeks. The steer showed a pronounced iodism under the treatment.

Post-mortem, January 27, 1893.—The superior maxilla slightly swollen. The maxillary sinus contains a little granulomatous tissue of a rather solid character, and not containing any pus. The lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 68000.

Red steer, white face, horns; received August 22, 1892.

In left parotid region, just below the ear, is located a hard, fibrous tumor the size of a double clinched fist. In submaxillary space is a similar one the size of a child's head.

Treatment was commenced August 24, with a daily dose of 12 grams, and was continued until October 7, with proper intervals. By this time an abscess had formed in the tumor below the ear, which was opened, and a few ounces of pus evacuated, after which the tumor rapidly disappeared. As the steer got sore feet from standing on the hard floor, he was turned out, and not taken in again until October 25. By this time the tumor under the jaw had shrunk to the size of a hen's egg and medicine was again administered two weeks. Shortly afterwards the steer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 39958.

Red steer, white star, hornless; received August 28, 1892.

In sublaryngeal space on left side is located a fibrous tumor the size of a large child's head. The superior maxilla on same side is a little swollen.

Treatment was commenced on August 30, with a daily dose of 12 grams, and was continued until October 28, with proper intervals. The steer showed only slight symptoms of iodism, but the tumor had by this time shrunk to the size of a goose egg, while the swelling on the upper jaw remained unchanged. From November 15 until December 29 medicine was again administered in doses, two or three times a week, and the remaining part of the tumor disappeared slowly.

Post-mortem, January 27, 1893.—The superior maxilla above the third molar slightly swollen. By opening the maxillary sinus is seen a bony new formation, the form and size of a cherry, extending from the socket of the molar up into the sinus. It contained granulomatous tissue, but no pus. No traces left of the tumor under the jaw. No internal lesions. The carcass was passed as sound.

No. 25.

No tag. Red steer, white star, horns.

Left lower maxilla swollen to the size of a double clinched fist.

At the post-mortem examination on January 27 the swelling proved to be spongy, filled with granulomatous tissue and pus. In the wall of the small intestines were a few small nodules. The carcass was condemned.

No. 39968.

Black steer, white star, hornless; received August 28, 1892.

In left sublaryngeal region is located a hard, fibrous tumor the size of a child's head.

Treatment was commenced on August 30, with a daily dose of 12 grams, and was continued until October 15, with proper intervals. The steer showed a pronounced iodism, and the tumor shrunk until about one-third of its original size. From November 10 until January 15 medicine was given about twice a week, and the tumor disappeared completely.

Post-mortem, January 27, 1893.—No traces of the tumor left. A few small nodules in the wall of the small intestines. The carcass was passed as sound.

No. 39973.

Red speckled steer, horns; received August 28, 1892.

In left parotid and sublaryngeal region is located a large, rather soft tumor the size of a cocoanut. On the left cheek there is a very hard, fibrous tumor the size of a hen's egg.

Treatment was commenced on August 30, with a daily dose of 12 grams, and was continued until October 20, with proper intervals. The little, hard tumor on the cheek disappeared remarkably fast, in about two or three weeks, and the larger one also shrunk considerably, the steer showing a well-pronounced iodism. From December 5 until January 20 medicine was again administered and the tumor shrunk to the size of a hen's egg.

Post-mortem, January 27, 1893.—In left parotid region is found a fibrous induration the size of a hen's egg. It contained traces of soft tissue. No internal lesions. The carcass was passed as sound.

No. 131017.

Dark-red steer, horns; received September 5, 1892.

In sublaryngeal region on the left side is located a hard fibrous tumor the size of a double clinched fist. On the lower end of it there is a white contracted scar, 3 to 4 inches in diameter.

Treatment was commenced September 7, with a daily dose of 10 grams, and continued until October 20. The tumor shrunk to about half its original size, but the thick indurations in the skin did not improve very much. From December 5 to January 15 medicine was given every second day, and the tumor shrunk constantly but slowly.

Post-mortem, January 27, 1893.—The skin under the throat indurated and about 1 inch thick. No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 59146.

Red steer, white brisket, hornless; received August 28, 1892.

In sublaryngeal region on right side is located a fibrous tumor the size of a child's head.

Treatment was commenced August 30, with a daily dose of 12 grams, and was continued until October 15. The steer showed very little iodism, and the tumor only shrunk to about half the original size. From November 10 until January 15 medicine was given about every second day, the tumor going down slowly.

Post-mortem, January 27, 1893.—In connective tissue under the throat is located a fibrous tumor the size of a small hen's egg. It contains a few centers of soft tissue of a rather dense character. The left sublaryngeal lymph gland swollen to about double its size, containing several small pus foci. A few small nodules in the wall of the small intestines. No other internal lesions. The carcass was passed as sound.

No. 25886.

Red steer, white spot on each shoulder, horns; received September 12, 1892.

In sublaryngeal region, on right side, is located a hard, fibrous tumor the size of a cocoanut. From its lower surface depends a cylindrical granuloma, 3 inches thick, covered with thin epidermis, and 5 to 6 inches long.

Treatment was commenced on September 14, with a daily dose of 12 grams. The fibrous tumor shrunk very rapidly, but the granuloma remained almost unchanged. On November 20 the large fibrous tumor had disappeared completely, leaving the granuloma hanging loose from the skin, with no connection with the underlying tissue. It had by this time shrunk about 3 inches, and had the form and size of a goose egg, attached with the broad end to the skin, and was now of an almost fibrous character.

Post-mortem, January 27, 1893.—No notes taken about the granuloma, which has been left in the skin and overlooked. Lymph gland on head sound. No internal lesions. The carcass was passed as sound.

No. 131033.

Red steer, white star, and spot on shoulder and hip, horns; received September 5, 1892.

In sublaryngeal space on right side is located a tumor the size of a double clinched fist.

Treatment was commenced on September 7, with a dose of 10 grams, and was continued until October 15, when the tumor had disappeared. About October 25 the respiration for the first time was accompanied by a snoring sound. The breathing was extremely difficult, the steer's appetite failed, and it lost rapidly in flesh, and stood with the head stretched forward, with staring eyes. Medicine was at once administered in doses of 15 grams a day, and with good success. In less than a week the respiration became almost normal, the steer regained its appetite, and soon picked up in flesh again. Above the pharynx could be felt a tumor the size of a goose egg. Medicine was then given in doses of 10 grams about every second day, and December 10th the steer was regarded as cured.

Post-mortem, January 27, 1893.—Right postpharyngeal lymph gland, containing a few small pus foci, was swollen to about three times its original size. No internal lesions. The carcass was passed as sound.

No. 39982.

Roan steer, white brisket, hornless; received August 28, 1892.

In the loose connective tissue, in the submaxillary space, are located four hard, fibrous tumors, the size of goose egg. Two similar ones of the same size are located in the left parotid region.

Treatment was commenced on August 30, with a daily dose of 12 grams, and was continued until October 20. The steer showed no symptoms of iodism and the tumors had only shrunk a little. From November 12 the medicine was given again, and the tumors now improved fast. January 15, the steer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 33.

No tag, N. M. Spotted dehorned steer.

Post-mortem, January 27, 1893.—In the left parotid region was located a fibrous tumor the size of a double clinched fist. It was closely covered by the skin and contained several centers of soft, granulomatous tissue, out of which pus drops might be squeezed.

No internal lesions. The carcass was condemned.

No. 39970.

Dark red steer, horns; received August 28, 1892.

In sublaryngeal space, on right side, is located a fibrous tumor the size of a child's head, on the lower surface of which is located a granuloma 3 to 4 inches in diameter. In parotid region on same side there is a similar one, the size of a goose egg.

Treatment was commenced on August 30, with a daily dose of 12 grams, and was continued until October 28, but with little success. The steer showed no symptoms of iodism, and the tumors remained almost unchanged, and the granuloma showed no tendency to dry up. Medicine was again administered from November 10 until January 15, but the tumors only shrunk to about half their original size and the granuloma became a little smaller.

Post-mortem, January 27, 1893.—In sublaryngeal region is located a hard, fibrous tumor the size of a double clinched fist, containing numerous pockets and centers filled with soft granulomatous tissue and pus. In parotid region is a fibrous induration the size of a walnut. Lymph glands on head sound. No internal lesions. The carcass was condemned.

No. 35.

No tag, N. M. Red dehorned steer, white star in forehead, stripes on shoulder, white belly.

Post-mortem, January 27, 1893.—In sublaryngeal region is located a fibrous induration the size of a clinched fist, containing a few centers of granulomatous tissue, of a rather solid character, not containing pus. No internal lesions. The carcass was passed as sound.

No. 39954.

Red steer, hornless; received August 28, 1892.

In left parotid region is located a hard, fibrous tumor the size of a clinched fist. It is open on the most prominent point and pus flows out. Under the throat, on the right side, is a similar tumor, the same size.

Treatment was commenced on August 30, with a daily dose of 10 grams, and was continued until October 20, when the steer was regarded as cured. The animal showed a pronounced iodism.

Post-mortem, January 27, 1893.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 39967.

Red steer, white star, white belly, hornless; received August 28, 1892.

In the submaxillary space are located five tumors, the largest the size of a goose egg, the smallest the size of a walnut.

Treatment was commenced on August 30, with a daily dose of 12 grams, and was continued until October 20, when the tumors had shrunk to half their original size.

From November 12 until December 30 medicine was given twice a week, and the tumors disappeared completely.

Post-mortem, January 27, 1893.—No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 39971.

Brindle steer, white forehead, horns; received August 28, 1892.

Left superior maxilla is slightly swollen and covered by an ulcer 3 inches in diameter.

Treatment was commenced on August 30, with a daily dose of 10 grams, and was continued until October 15, with proper intervals. By this time the ulcer had dried up, and only left a little contracted scar. From November 12 until January 15, medicine was given twice a week, apparently without further improvement.

Post-mortem, January 27, 1893.—The skin covering the upper maxilla a little indurated. The maxillary sinus contained an actinomycotic new formation the size of a hen's egg, but of a rather fibrous character, and not containing any pus. No internal lesions. The carcass was passed as sound.

No. 40.

No tag. N. M. Red roan, dehorned steer.

Post-mortem, January 27, 1893.—Left upper maxilla slightly swollen and covered with a layer of fibrous tissue. Small new formations in maxillary sinus. A few small nodules in wall of small intestines. The carcass was passed as sound.

No. 39986.

Red steer, white face and back, hornless; received August 28, 1892.

In the intermaxillary space are located three hard, fibrous tumors the size of goose eggs.

Treatment was commenced August 30, and was continued until October 14, when all three tumors had disappeared. The steer showed a pronounced iodism and lost in condition under the treatment.

Post-mortem, January 27, 1893.—The skin covering the submaxillary space slightly indurated. Lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 25855.

Red speckled steer, hornless; received September 12, 1892.

The sub and intermaxillary region is filled with an oblong fibrous tumor formation, closely attached to the covering skin.

Treatment was commenced September 14, with a daily dose of 12 grams, and was continued until October 25, when the swelling had almost disappeared. One of the sublingual glands could then be felt swollen to the size of a hen's egg. Medicine was given from November 10 to November 25, when the steer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of the swelling left. No internal lesions. The carcass was passed as sound.

No. 45879.

Red steer, hornless, white shoulders and hips; received September 5, 1892.

In sublaryngeal region are located three distinct fibrous tumors in close connection, together the size of a cocoanut. On outside of the largest one is an ulcerating granuloma 3 inches in diameter.

Treatment was commenced on September 7, with a daily dose of 12 grams, and was continued until October 27. The steer only showed slight symptoms of iodism, but the tumors shrunk slowly, and the ulcer dried up. From November 12 until January 17 medicine was administered, and the tumors disappeared, only leaving the covering skin hard and indurated with a white contracted cicatrix thereon.

Post-mortem, January 27, 1893.—No traces of the tumors left except the induration in the skin. No internal lesions. The carcass was passed as sound.

No. 44.

No tag. Red steer with white shoulders and belly.

Post-mortem, January 27, 1893.—In left parotid region is a fibrous tumor the size of a double clinched fist, almost entirely consisting of white fibrous tissue, with a few deposits of soft tissue. On the outside of it is located a dried-up granuloma, the size of a hen's egg. The carcass was passed as sound.

No. 533794.

Red steer, white star and white on hips; received August 22, 1892.

In left parotid region is located a hard, fibrous tumor the size of a clinched fist. From this extends a softer swelling filling the whole sublaryngeal space, extending on the right side up into the parotid region toward the ear.

Treatment was commenced on August 24, with a daily dose of 12 grams, and was continued until October 12. By this time the soft swelling in the sublaryngeal space had almost disappeared, while the tumor on the left side still remained, though it had shrunk a little. From November 9 until December 20 medicine was given regularly, and from then until January 20 every second day. The tumor beneath the left ear did not disappear entirely.

Post-mortem, January 27, 1893.—In left parotid region is a fibrous tumor the size of a walnut, containing a small amount of pus. In the surrounding tissue were located a few small centers of soft tissue. In the walls of the small intestines were located a few small, hard nodules. The carcass was passed as sound.

No. 534105.

Dark red steer, dehorned; received August 22, 1892.

In the submaxillary and sublaryngeal space is located an immense, soft, undulating tumefaction the size of a half-peck measure. On the right cheek, outside the third molar, is a hard, fibrous tumor the size of a clinched fist.

Treatment was commenced August 24 and continued until October 25, with a daily dose of 12 grams. The steer showed a pronounced iodism and the tumefaction improved fast. By this time the tumor on the cheek had almost disappeared, while the swelling underneath was not one-third its original size. From November 11 until January 20 the medicine was given two to three times a week, and the head of the steer almost regained its normal appearance.

Post-mortem, January 27, 1893.—In the sublaryngeal space is a soft, fibrous induration containing a number of small fibrous nodules, varying in size from a pea to a bean, containing no pus, but a small amount of soft tissue. Lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 131038.

Brown steer, horns; received September 5, 1892.

In right parotid region is located a hard, fibrous tumor, the size of a double clinched fist.

Treatment was commenced on September 7, with a daily dose of 10 grams, and continued until October 25, with proper intervals. The steer showed a pronounced iodism and the tumor disappeared altogether.

Post-mortem, January 27, 1893.—No traces of the tumor left. Lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 45973.

Black steer, speckled back and breast, dehorned; received September 5, 1892.

In left parotid region is located a hard, fibrous tumor the size of a goose egg. A similar one the size of a child's head is located in the submaxillary space.

Treatment was commenced on September 7, with a daily dose of 12 grams, and continued until October 22. The steer showed a pronounced iodism, and the tumors shrunk fast. From November 9 until December 20 medicine was again administered, and both tumors disappeared completely.

Post-mortem, January 27, 1893.—No traces of the tumors left, except a slight induration in the skin. Lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 45909.

Dark-red steer, white star and spot on shoulders, ears cut; received September 5, 1892.

In sublaryngeal and submaxillary space is located a large, fibrous tumor, on the lower surface of which is located an ulcerating granuloma, 6 to 7 inches in diameter.

Treatment was commenced on September 7, with a daily dose of 12 grams, and continued until October 20. The steer showed a pronounced iodism, and the fibrous parts of the tumor shrunk and contracted so fast that a large piece of the granuloma was expelled and the rest dried up and disappeared, leaving a white contracted scar. Medicine was again administered from November 10 until January 20, when the tumefaction had disappeared, only leaving the skin hard and indurated.

Post-mortem, January 27, 1893.—No traces of the tumor left, except a fibrous induration in the skin showing traces of soft tissue. No internal lesions. The carcass was passed as sound.

No. 40733.

Brown bull, horns; received August 30, 1892, from Kansas City.

In the submaxillary space on the right side is located a hard, fibrous tumor the size of a child's head. On the right cheek is a similar one the size of a goose egg.

Treatment was commenced September 1, by a daily dose of 12 grams, and continued until December 25, with proper intervals. The steer showed a pronounced iodism, and the tumor on the cheek disappeared fast, while the larger one shrunk considerably. From November 10 until December 28 medicine was again administered, and the remaining tumor disappeared slowly, leaving the skin indurated.

Post-mortem, January 27, 1893.—No traces of the tumor left. Lymph glands on head sound. In the wall of the small intestines were found located a few small, hard nodules. The carcass was passed as sound.

No. 131063.

Black steer, horns, ears cut; received September 5, 1892.

In sublaryngeal space is located a hard, fibrous tumor the size of a child's head.

Treatment was commenced September 7, with a daily dose of 10 grams, and continued until October 22, when the tumor had almost disappeared. The steer showed a pronounced iodism.

Post-mortem, January 27, 1893.—No traces of the tumor left, except a fibrous induration in the skin. Lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 45932.

Roan bull, hornless; received September 5, 1892.

In the loose connective tissue under the skin covering the sublaryngeal region on the left side is located a tumor the size of a double clinched fist. It is hard and fibrous, with a smooth surface. On the lower end there is a scar, and here the skin is in close connection with the tumor. (See Plate II.)

The treatment was commenced September 6 by giving a dose of 15 grams iodide of potassium daily, with proper intervals of about one or two days a week. The medicine did not have any marked effect on the bull, which only showed vague symptoms of iodism, the tumor shrinking but slowly. At the end of the fourth week the treatment was stopped, the tumor having then shrunk to about one-third its original size. In less than three weeks the rest disappeared without any further treatment, leaving only a hard fibrous thickening in the skin, the size of the palm of a hand, which made it look as if there was still a tumor there, but by manipulation no traces of the original lump could be detected.

Post-mortem, January 27, 1893.—The skin covering the left parotid region a little indurated, and covered by a white scar. Lymph glands on head sound. On surface of liver a small nodule the size of a bean. The carcass was passed as sound.

No. 53.

No tag; red, hornless steer, white belly, white spot on left side.

Post-mortem, January, 27, 1893.—No lesions of any kind found. The carcass was passed as sound.

No. 39990.

Roan dehorned heifer; received August 28, 1892.

In the submaxillary space is located a hard, fibrous tumor the size of a large cocoanut.

Treatment was commenced August 30, with a daily dose of 10 grams, and was continued until October 25, with proper intervals. The heifer showed no symptoms of iodism, and the medicine had hardly any effect on the tumor. The treatment was continued from 9th of November until January 25, but without success. The tumor only shrunk a little.

Post-mortem, January 27, 1893.—In left side of the submaxillary space was located a hard, fibrous tumor the size of a child's head, containing several centers of soft granulomatous tissue and pus. No internal lesions. The carcass was condemned.

No. 531549.

Red steer, hornless; received August 22, 1892.

In the sublaryngeal space on the left side is located a hard, fibrous tumor the size of a double clinched fist.

Treatment was commenced on August 24, with a daily dose of 12 grams, and was continued until October 15, when the tumor had disappeared. The steer showed a pronounced iodism.

Post-mortem, January 27, 1893.—No traces of the tumor left. No internal lesions. The carcass was passed as sound.

No. 45930.

Red bull, hornless; received September 5, 1892.

In sublaryngeal space on left side is located a hard, fibrous tumor the size of a child's head, lying loose in the connective tissue under the skin.

Treatment was commenced on September 7, with a daily dose of 12 grams, and was continued until October 20, when the tumor had shrunk to the size of a clinched fist. From November 10 until December 20 medicine was again administered and the rest of the tumor disappeared.

Post-mortem, January 27, 1893.—No traces of the lump left. No internal lesions. The carcass was passed as sound.

No. 59131.

White steer, hornless; received August 30, 1892, from Kansas City.

The left upper maxilla is slightly swollen. In sublaryngeal space on left side is located a hard, fibrous tumor the size of a cocoanut.

Treatment was commenced September 1, with a daily dose of 12 grams, and was continued until October 20, when the soft tumor had almost disappeared, while the bony swelling remained the same. The treatment was continued from November 10 to January 20. The steer showed a pronounced iodism, and the tumor underneath disappeared completely.

Post-mortem, January 27, 1893.—The left upper maxilla is swollen slightly. The maxillary sinus was completely filled with actinomycotic new formations extending into the nasal fossa. The three first molars were pushed slightly outward. Lymph glands on head sound. No internal lesions. The carcass was condemned.

No. 39962.

Red heifer, white belly; received August 28, 1892.

In left sublaryngeal space is located a tumor the size of a double clinched fist.

Treatment was commenced on August 30, with a daily dose of 10 grams, and continued until October 10, when the heifer was cured.

Post-mortem, January 27, 1893.—No traces of the tumor left, no internal lesions. The carcass was passed as sound.

No. 40000.

Red cow, hornless; received August 22, 1892.

In left parotid region is located a large, rather soft tumor, extending from the ear down into the sublaryngeal region.

Treatment was commenced on August 24, with a daily dose of 10 grams, and continued until October 27, when the whole tumor had disappeared, except a fibrous induration in the skin.

Post-mortem, January 27, 1893.—No traces of the tumor left, except a fibrous induration in the skin. No internal lesions. The carcass was passed as sound.

No. 45927.

Brindle steer, white star, hornless; received September 5, 1892.

In sublaryngeal space is located a fibrous tumor the size of a cocoanut, and a similar one the size of a goose egg in the intermaxillary space.

Treatment was commenced on September 7, with a daily dose of 10 grams, and continued until October 10. The steer showed a pronounced iodism, and the tumors shrunk considerably. From November 12 until December 20, medicine was again administered, and the tumors disappeared completely.

Post-mortem, January 27, 1893.—No traces of the tumors left, except an induration in the skin. No internal lesions. The carcass was passed as sound.

No. 39996.

Red bull, dehorned; received August 28, 1892.

In sublaryngeal space is located a fibrous tumor the size of a child's head. On the inside of the lips are located a few small granulomas.

Treatment was commenced on August 30, with a daily dose of 12 grams, and continued until October 25. The bull showed hardly any symptoms of iodism, and the tumor shrunk but slowly. The granulomas on the lips disappeared after two weeks' treatment. Medicine was given from November 10 until December 20, when most of the tumor had gone.

Post-mortem, January 27, 1893.—No traces of tumors left, except a fibrous induration in the skin. No internal lesions. The carcass was passed as sound.

No. 62.

No tag. Red steer, hornless, white face and neck.

Post-mortem, January 27, 1893.—No traces of actinomycosis found. The carcass was passed as sound.

No. 45918.

Speckled steer, red head and neck, hornless; received September 5, 1892.

In sublaryngeal space is located a fibrous tumor the size of a cocoanut. On the lower surface is located an ulcer, from 5 to 6 inches in diameter.

Treatment was commenced September 7, with a daily dose of 12 grams, and continued until October 20, with proper intervals. The steer showed a well-pronounced iodism, and the ulcer soon dried up and shrunk. From November 10 until January 20 medicine was again administered and the tumor disappeared entirely, leaving a hard, fibrous induration in the skin, covered by a white scar.

Post-mortem, January 27, 1893.—No traces of the tumor left, except the induration in the skin. In sublingual gland a granuloma the size of a walnut, not containing any pus. No internal lesions. The carcass was passed as sound.

No. 64.

No tag. Black, dehorned steer.

Post-mortem, January 27, 1893.—In submaxillary space a fibrous induration 2 inches thick, showing traces of soft tissue. Lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 65.

No tag. Red steer, horns, white face.

Post-mortem, January 27, 1893.—On left lower maxilla was a bony tumor the size of a double clinched fist. The internal parts of the tumor were spongy, and contained numerous cavities filled with soft granulomatous tissue and pus. No internal lesions. The carcass was condemned.

No. 48140.

Red steer, white star, hornless; received August 30, 1892, from Kansas City.

In right upper maxilla is a fibrous enlargement the size of a clinched fist. On the most prominent point is located a small ulcer 1 to 2 inches in diameter.

Treatment was commenced on September 1, and continued until October 20, when the fibrous points of the tumor had shrunk and the ulcer dried up. The treatment was continued from November 10 until January 20, with doses twice a week.

Post-mortem, Januarg 27, 1893.—The swelling on the right upper maxilla is covered by a thin layer of fibrous tissue, inclosing a few small centers of soft tissue containing pus. The maxillary sinus is completely filled by actinomycotic new formations, extending into the nasal fossa. Lymph glands on head sound. No internal lesions. The carcass was condemned.

No. 44534.

Red steer, large horns; received September 12, 1892.

In right parotid region are located three tumors the size of goose eggs, a similar one the size of a cocoanut in sublaryngeal region, and two the size of goose eggs in left parotid region.

Treatment was commenced on September 14, with a daily dose of 12 grams, and continued until October 25. October 2 two abscesses were formed in right parotid region. The steer showed a pronounced iodism and all the tumors shrunk considerably.

From November 12 medicine was again administered, and the tumors disappeared, leaving only a fibrous induration in the skin.

Post-mortem, January 27, 1893.—No traces of tumors left. Lymph glands on head sound. Mesenteric glands swollen to the size of hen's eggs containing pus (probably not actinomycotic). Numerous small abscesses in both lungs. The carcass was condemned.

No. 45969.

Red steer, white star and rump; dehorned; received September 5, 1892.

In left parotid region were located two tumors the size of hen's eggs. Three similar ones the size of goose eggs in intermaxillary space.

Treatment was commenced on September 7, with a daily dose of 10 grams, and continued until September 29, when the steer was almost cured. It showed a pronounced iodism.

Post-mortem, January 27, 1893.—No traces of tumors left. In liver an abscess the size of a hazelnut. The carcass was passed as sound.

No. 69.

No tag. Speckled steer, horns.

Post-mortem, January 27, 1893.—All the left side of the face immensely swollen from the eye down to the nose. The bony swelling covered by a thin layer of fibrous tissue. The maxillary sinus is filled with granulomatous tissue, and the bordering bones are rarefied. The actinomycotic new formations extend into the nasal fossa almost down to the nostril. The carcass was condemned.

No. 541268.

Strawberry roan steer, dehorned; received August 16, 1892.

On the right cheek are located three hard tumors the size of walnuts. In submaxillary space is a tumor the size of a child's head.

Treatment was commenced August 17, with a daily dose of 10 grams. On August 22, there appeared suddenly a granulomatous growth in the middle of the forehead, and another one behind the crest of the occiput. They were both round, 2 inches in diameter, red, and blood-filled, and looked like a large strawberry. The dose of medicine was increased to 12 grams a day, and in less than a week they had both completely disappeared. The treatment was continued until October 12, when all the tumors had disappeared.

Post-mortem, January 27, 1893.—No traces of tumors left. No internal lesions. The carcass was passed as sound.

No. 45896.

Red steer, speckled side and back; received September 5, 1892.

In left parotid region and sublaryngeal space is located a rather soft tumor the size of a child's head.

Treatment was commenced on September 7, and continued until October 22, with a daily dose of 12 grams. The steer showed a pronounced iodism, and the tumor shrunk fast. From November 10 until December 15 medicine was again administered, and soon afterwards the tumor had disappeared completely.

Post-mortem, January 27, 1893.—No traces of tumor left. Sublingual lymph glands indurated and swollen to the size of a walnut, containing a few drops of pus. No internal lesions. The carcass was passed as sound.

No. 45942.

Brown steer, hornless; received September 5, 1892.

In sublaryngeal region on left side is located a hard, fibrous tumor, the size of a large cocoanut. On lower surface there is an ulcerating granuloma 4 to 5 inches in diameter.

Treatment was commenced on September 7, with a daily dose of 12 grams, and continued until October 25. The steer showed hardly any symptoms of iodism, and the tumefaction only improved slowly. Medicine was again administered from November 10 until January 20, but the tumor only shrunk to about half the original size, and the granuloma grew a good deal smaller, without showing any tendency to dry up.

Post-mortem, January 27, 1893.—The parotid glands on both sides swollen and containing several pus foci. In sublingual space is located a fibrous tumor, the size of a child's head, containing one big pus cavity, and several small centers of soft tissue and pus. In both lungs were numerous small abscesses. The carcass was condemned.

No. 73.

No tag. Dark red steer, horns.

Post-mortem, January 27, 1893.—On right lower maxilla is a bony swelling the size of a clinched fist. The internal parts of the tumor were spongy, and contained a quantity of soft tissue and pus. The carcass was condemned.

No. 74.

No tag. Dark red bull, horns.

Post-mortem, January 27, 1893.—In submaxillary space is a small fibrous induration in the skin. No traces of soft tissue. No internal lesions. The carcass was passed as sound.

No. 75.

No tag. Red steer, hornless, white star, belly and flank.

Post-mortem, January 27, 1893.—On right lower maxilla is a bony enlargement the size of a hen's egg. The internal parts were rather compact and only spongy in the center, where a small amount of granulomatous tissue was present. No internal lesions. The carcass was passed as sound.

No. 39956.

Speckled steer, hornless; received August 28, 1892.

In submaxillary space are located three hard fibrous tumors the size of a goose egg, loose in connective tissue under the skin. On right cheek a similar one the size of a hen's egg.

Treatment was commenced on August 30, with a daily dose of 12 grams, and continued until October 20. The steer showed a pronounced iodism, and the tumors disappeared completely.

Post-mortem, January 27, 1893.—Small fibrous indurations in the skin in submaxillary space. Large contracted scar on anterior surface of liver. The carcass was passed as sound.

No. 77.

No tag. Spotted steer, horns.

Post-mortem, January 27, 1893.—On left lower maxilla is a bony tumor the size of a double clinched fist. It is covered by a thick layer of fibrous tissue, containing several centers of soft tissue. The internal parts of the tumor were spongy, the cavities filled with soft tissue and pus. No internal lesions. The carcass was condemned.

No. 545789.

Red steer, speckled on head, brisket, belly, and legs; received August 16, 1892.

All the left side of the face from eye to nostril considerably swollen. Three inches below the eye is located an ulcer 4 to 5 inches in diameter. The swelling is hard and supposed to be bony in the deeper parts.

Treatment was commenced on August 18, with a daily dose of 10 grams, and continued until October 7, when the ulcer had healed up completely and the swelling had been reduced to the size of a goose egg. No more medicine was given until November 10, and the swelling improved slowly, and it was therefore concluded that it did not extend into the maxillary sinus. From November 10 until January 20 medicine was given about twice a week and the swelling shrunk so that it was hardly noticeable.

Post-mortem, January 27, 1893.—The left upper maxilla a little swollen, covered by a thin layer of fibrous tissue, not containing any soft tissue. The bone itself is a little rarefied, but the lesion does not extend into the sinus. The infection has probably taken place through some external abrasion in the skin. The lymph glands on head sound. No internal lesions. The carcass was passed as sound.

No. 59092.

Brindle heifer, white face and back, dehorned; received August 28, 1892.

In submaxillary space are located three fibrous tumors, the size from a child's head to a goose egg, closely connected with each other. (See Plate I.)

Treatment was commenced on August 30 with a daily dose of 10 grams and continued until October 25, when there only remained one tumor the size of a goose egg. The heifer showed a pronounced iodism. From November 10 until December 15 medicine was again administered, when the heifer was regarded as cured.

Post-mortem, January 27, 1893.—No traces of the tumors left. Lymph glands on head sound. No internal lesions except a cysticircus bovis in the liver. The carcass was passed as sound.

No. 252388.

Red steer, white on left flank and belly, white forehead; received July 25, 1892.

The left lower maxilla is immensely swollen from the chin to the angle of the jaw. The swelling is of a fibrous character, but seems to be bony in the deeper parts. The surface is covered by two ulcerating granulomas, the smaller one 1½ inches in diameter, and the larger one almost circular, 5 to 6 inches in diameter. The granulomas are partly covered with dried pus, and are partly raw and bleeding. In the parotid region on the same side are located two tumors, one just below the ear and the size of a hen's egg, and below this another the size of a clinched fist. Both of these tumors were slightly fluctuating. The deformation of the lower maxilla has interfered considerably with the mastication, so the steer is only able to eat soft or ground feed, but no hay. When not eating he is constantly grinding his teeth, and the saliva flows incessantly from his mouth. The steer is in very poor condition, lies down most of the time, and looks as if he had not many more days to live.

The treatment was commenced July 27, with a dose of 10 grams of iodide of potassium. The three following days a solution of 5 grams of iodide of potassium in 15 grams of distilled water was injected into the jugular vein, but had to be stopped, as there resulted phlebitis. The same treatment was then tried hypodermically, the solution being made a little weaker (1–4), but this resulted in a necrosis of the tissue at the place of injection. The treatment was therefore continued by giving the medicine internally until the 1st of September. The steer showed pronounced iodism, the granulomas dried up and shrunk, and the whole tumefaction was reduced to less than one-third its original size. The ulcers, which in the beginning were exceedingly fetid, were washed in a 2-per cent solution of creolin and dusted with iodoform and boracic acid, equal parts. The two tumors in the parotid region had been opened with a knife and a small amount of pus evacuated. From September 15 till October 15 medicine was again administered and the tumor on the jaw was reduced to a small fibrous induration in the skin, covered by a pink cicatrix, the size of a silver dollar. The two tumors in the parotid region disappeared completely. The lesion did not extend into the bony tissues of the lower maxilla as was at first supposed. About November 1 the steer was regarded as cured and was in splendid condition.

Post-mortem, January 29, 1893.—On the left cheek and in left parotid region is a slight fibrous induration of the skin. No traces of soft tissue left. No internal lesions. The carcass was passed as sound.

No. 159687.

Light red steer, hornless; white forehead, white marks on belly, flank, and legs; received July 25, 1892.

On the right upper maxilla is located a swelling the size of a large goose egg, about 5 inches long and 3¼ inches wide. The swelling is bony, hard, and closely covered by the skin. On the lower end of it is located a small scar, where the skin has been broken, but now is healed up. The left upper maxilla is slightly swollen, hardly noticeable. On the inside of the upper lip are located two small flat actinomycomas 1¼ to 2 inches in diameter. The steer is in fairly good condition.

The treatment was commenced July 27, 1892, with a daily dose of 10 grams. August 1 the swelling had apparently increased a little, and the scar on the lower end broke open and a few drops of pus were discharged. For the first two weeks the tumor increased in size slowly, in spite of the increase in the dose to 12 to 15 grams a day. Then it commenced to shrink again, until it had reached the original size. About September 1 the upper maxilla on the left side began to swell, regardless of the large doses of medicine. This is the only case out of 192 animals affected with actinomycosis where the medicine did not at least arrest the progress of the disease, but the steer showed a perfect insusceptibility to the effect of the treatment. The administration of medicine was continued, with proper intervals, until the steer was slaughtered, by which time both tumors were about the same size, the one on the right side a little larger than originally. The two granulomas inside the upper lip disappeared after three or four weeks' treatment. An external application of iodine ointment to the tumors had no effect.

Post-mortem, January 29, 1893.—The maxillary sinuses on both sides completely filled with soft actinomycotic new formations, extending into the nasal fossa. Infection has evidently taken place through the dental alveols of the third molar on both sides, as they were pushed slightly out of their places. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.

No. 396938.

Red steer, white forehead, rudiments of horns; received July 30, 1892.

In the sublaryngeal region is located a hard, fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin. From the lower surface of the tumor projects a round, red granuloma about 4 inches in diameter.

Treatment was commenced August 1, with a daily dose of 12 grams, and was continued until January 20, 1893. The steer showed no symptoms of iodism and the tumor improved only slowly. About October 1 the tumor had shrunk to half its original size and the granuloma had dried up and shrunk to the size of a silver dollar. By this time an abscess formed in the left parotid region just below the ear, which broke open, and a small amount of pus was evacuated. The tumor kept on shrinking slowly and had almost disappeared when the animal was slaughtered.

Post-mortem, January 29, 1893.—In the sublaryngeal region is a fibrous induration in the skin about 1 inch thick, on the outside of which is located a white contracted cicatrix. In the left parotid region is a small induration in the skin. The lymph glands on the head were sound. In the upper part of the left lung was located an actinomycotic tumor the size of a child's head. The carcass was condemned.

No. 373406.

Red stag, horns; received July 30, 1892.

In the right parotid region is located a flat, hard, fibrous tumor the size of the palm of the hand. It is closely connected with the covering skin. In the center of the swelling is an open scar, out of which flow a few drops of yellow pus. In the sublaryngeal space, on the right side, is located a hard, fibrous tumor, the size of a goose egg, lying loose in the connective tissue under the skin. On the lower end of it is a small scar where it has been broken, and here the skin is in close connection with the tumor. On the middle of the right cheek, outside the third molar, is located a red granuloma the size of a silver half dollar. The surface is ulcerating and covered with pus crusts. The surrounding skin is hard and indurated. On the inside of the upper lip is located a small oblong granuloma one inch long and half an inch wide. (See Plate I.)

Treatment was commenced August 1, with a daily dose of 15 grams, and was continued until October 15, with proper intervals. The stag showed a pronounced iodism and the tumors improved rapidly. The granuloma in the mouth disappeared after two weeks' treatment. The one on the cheek dried up and disappeared after four weeks' treatment, and the hard swelling in the parotid region became soft and disappeared. From November 1 until November 15 medicine was again administered, and shortly afterwards the stag was regarded as cured.

Post-mortem, January 29, 1893.—No traces of the tumors left. No internal lesions. The carcass was passed as sound.

No. 294924.

White steer, horns; received July 30, 1892.

In the sublaryngeal space on the right side is located a hard, fibrous tumor the size of a double clinched fist, lying loose in the connective tissue under the skin.

On the left shoulder is located a red, soft granuloma the size of a large hen's egg. The surrounding skin is thick and indurated, but is not connected with the underlying tissue.

Treatment was commenced August 1, with a daily dose of 10 grams, and was continued until September 12, when the tumor in the sublaryngeal space had disappeared and the granuloma on the shoulder had shrunk to the size of a hazelnut. From September 20 to September 30 medicine was again administered and the steer was regarded as cured.

Post-mortem, January 29, 1893.—No traces of the tumors left; no internal lesions. The carcass was passed as sound.

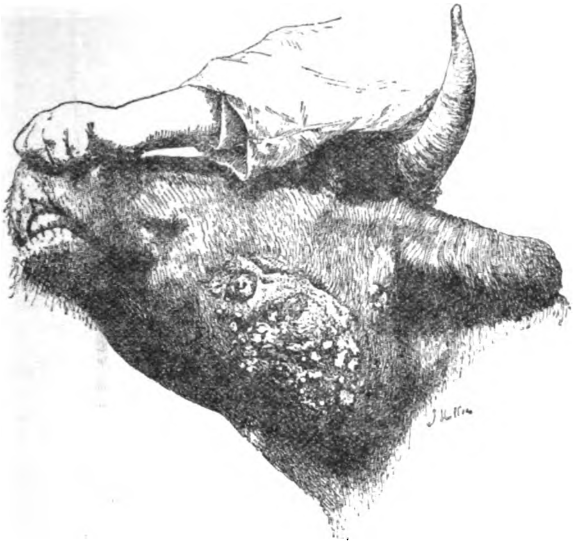
No. 322415.

Dark-red steer, horns; received July 25, 1892.

Both the lower maxillas, especially the left one, are immensely swollen from the chin to the neck. The swelling extends up over the left side of the face toward the eye. On the lower surface is located an ulcerating granuloma, 6 inches in diameter, and protruding 4 to 5 inches over the swollen edges of the surrounding tissue. The whole tumefaction is the size of a half-peck measure. The teeth in the left lower maxilla are pushed out of their sockets, so that mastication is considerably impaired.

Treatment was commenced July 27, with a daily dose of 10 grams, and was continued until January 25, 1893, with proper intervals, some of these extending over two or three weeks. The steer showed no symtoms of iodism whatever, even if the doses were increased to 15 grams per day and continued for two weeks without stopping; consequently the effect on the tumor was very little. The granuloma did not dry up after the treatment had been continued for three months, and neither this nor the fibrous tumor became smaller. Injections into the granuloma of a concentrated solution of iodide of potassium or of tincture of iodine only produced a small abscess at the place of injection, which would break open and a small amount of pus be evacuated. In spite of the daily doses of medicine the steer, which was rather poor at first, put on flesh and became fat.

Post-mortem, January 29, 1893.—The granuloma was covered with a thin layer of epidermis, and was not soft, but had become of a more fibrous character. A section through it proved it to consist of a stroma of fibrous tissue in which were embedded the larger and smaller centers of granulomatous tissue. This is of a dense character and does not contain pus. The surrounding parts of the tumefaction consisted of white, fibrous tissue, with no traces of soft tissue. The lower maxilla was considerably swollen, the inner parts being spongy and containing numerous centers of soft tissue, but no pus. The lymph glands on the head were sound. No internal lesions. The carcass was condemned.



252388

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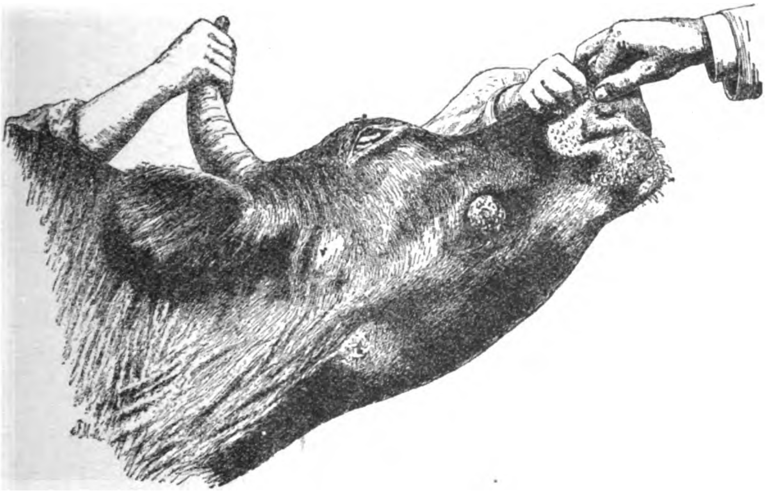

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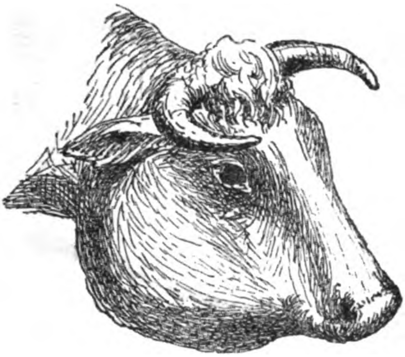

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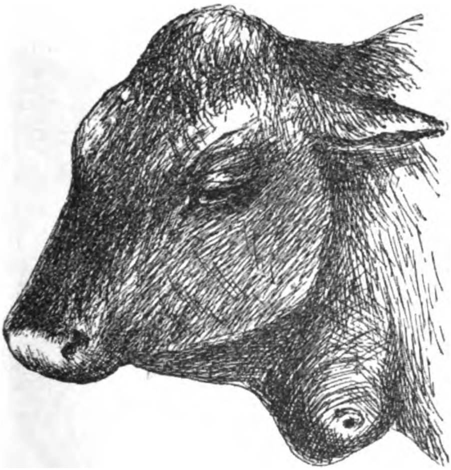

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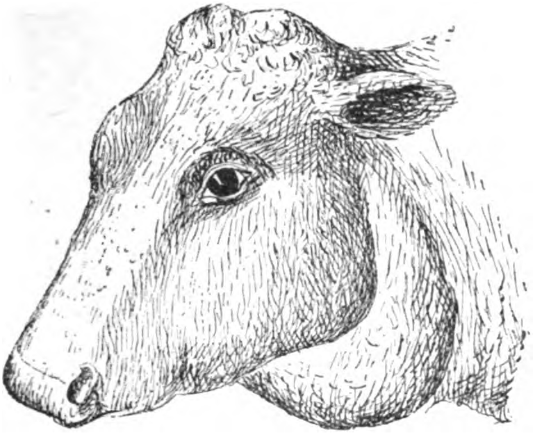

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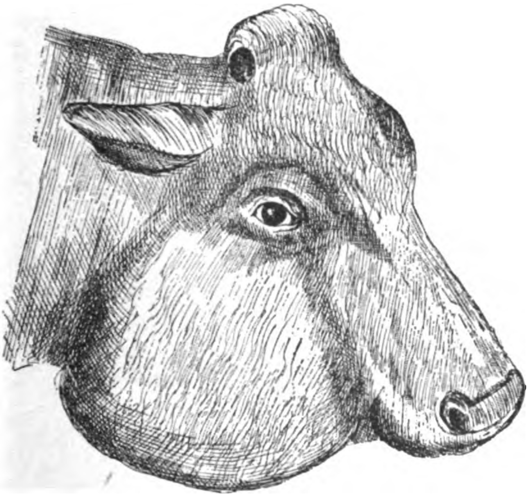

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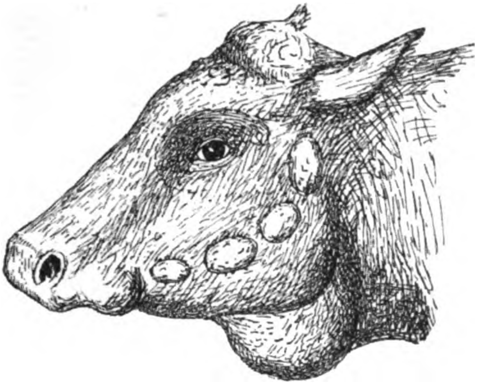
ANIMAL TREATED, BUT NOT CURED.



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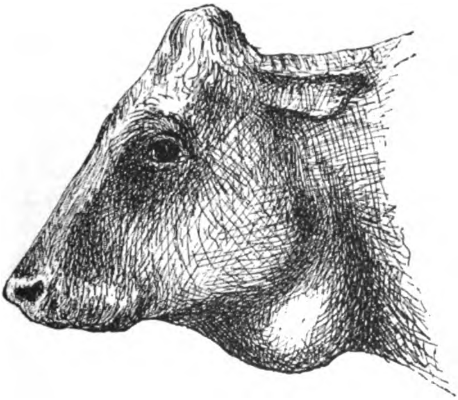

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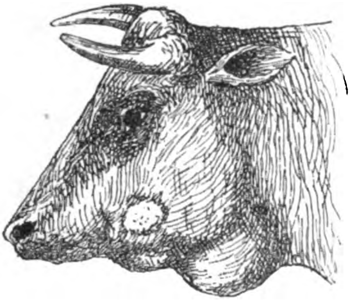

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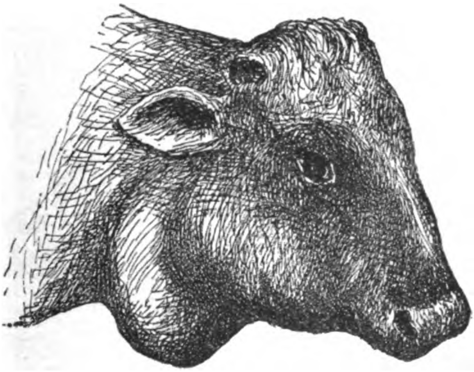

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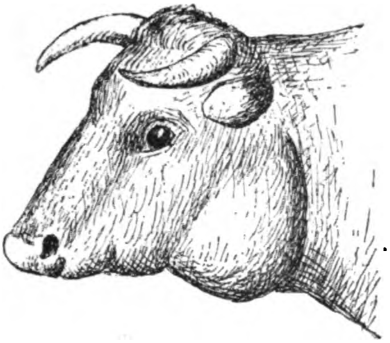

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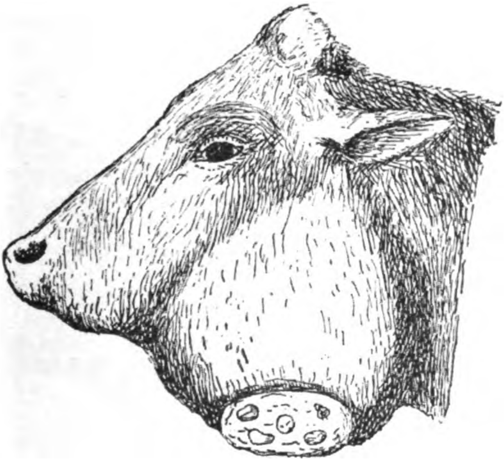

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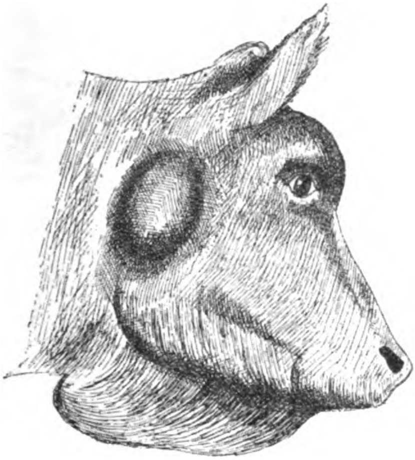

533796

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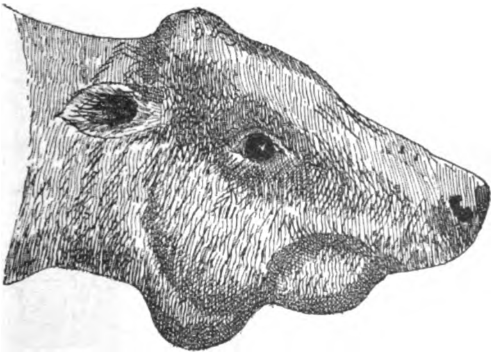

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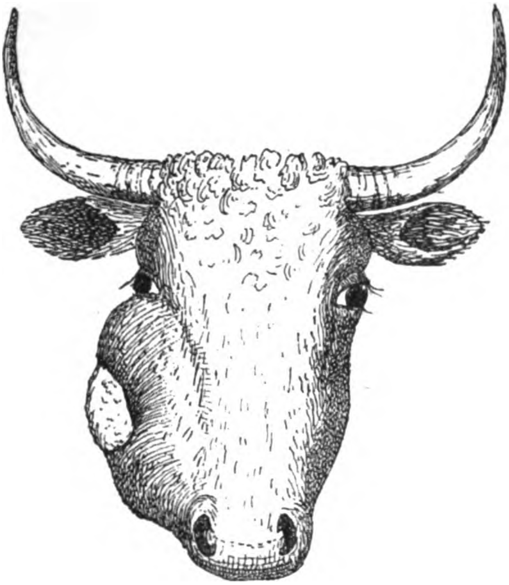
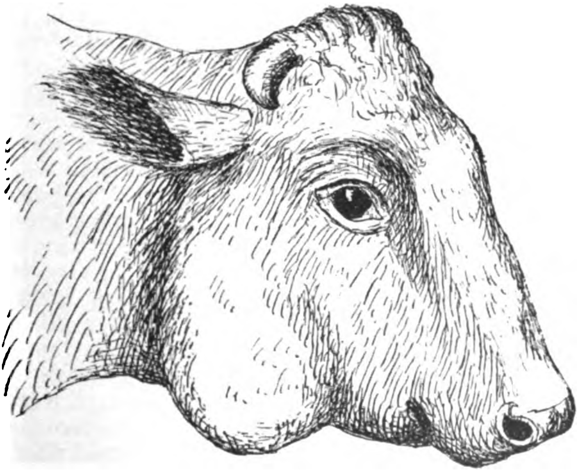


130915

ANIMAL TREATED, BUT NOT CURED.



499857

BEFORE TREATMENT—AFTERWARD CURED.

INVESTIGATIONS INTO THE NATURE, CAUSATION, AND PREVENTION OF SOUTHERN CATTLE FEVER.

By **THEOBALD SMITH**, Ph. B., M. D., and **F. L. KILBORNE**, B. Agr., B. V. S.

HISTORICAL REVIEW.

Up to the time at which these investigations were begun, a certain number of very important facts had already been ascertained and repeatedly confirmed concerning the nature of Texas or Southern cattle fever. There were also a number of theories in the field concerning the causation or etiology of this disease, based in part on investigation, in part on speculation.

Of those definitely ascertained facts, we may mention as the most important the one which traced the distribution of the infection to cattle brought from a large but well-defined territory, including most of the Southern States, into more northerly regions. The Southern cattle bearing the infection were, as a rule, free from any signs of disease. It was likewise settled that this infection was carried only during the warmer season of the year, and that in the depth of winter Southern cattle were harmless. It was also known that the infection was not communicated directly from Southern to Northern cattle, but that the ground over which the former passed was infected by them, and that the infection was transmitted thence to susceptible cattle. All that was necessary for the production of disease was the passage of Southern cattle over a given territory and the grazing of Northern cattle over the same or a portion of the same territory during the same season.

It was also discovered that Southern cattle, after remaining for a short time on Northern pastures, lost, in some mysterious way, the power to infect other pastures and were, for the remainder of their stay North, harmless. Again, cattle driven over a considerable distance lost, after a time on their way, the power to infect pastures. When pastures and trails had been passed over by Southern cattle, it was observed that the disease did not appear at once in the Northern cattle grazing on them, but that a certain period of not less than thirty days elapsed before the native cattle began to die. More curious even than these facts was the quite unanimous testimony of stock-owners who had had more or less experience with this disease, that native susceptible animals which had become diseased did not transmit the disease to other natives, and that they were harmless. We shall discuss this statement in detail, in connection with experiments made to test its accuracy.

If we turn our attention to the opposite aspect of this interesting series of facts, which deals with the introduction of Northern cattle into Southern territory, we learn that such cattle may contract Southern cattle fever, and that it is only under considerable risks that Northern cattle can be introdued into what has been called the permanently infected territory.

These interesting facts about a mysterious disease were largely reasoned out by farmers and stock-owners in their trying experience with it, and were well known before 1868, when the disease began to arouse the attention of the Government, owing to its widespread devastations in the Northern States in that year. The historical record of the development of these ideas is therefore very meager. That Southern cattle in a state of health might bring destruction to Northern herds was observed late in the last century by Dr. Mease. A herd of cattle was driven in 1796 from South Carolina into Pennsylvania, where disease broke out in Lancaster County and other places. This disease was directly traced to the Southern herd by Dr. Mease, who made it the subject of an interesting communication, and dwelt particularly upon the fact that the cattle bringing the disease were themselves in good health.

In 1868, Texas cattle shipped up the Mississippi River to Cairo and thence by rail into Illinois and Indiana early in June, caused, during the summer of that year, enormous losses of cattle in these States. Moreover, the East began to be aroused because Western cattle infected with the disease had been shipped eastward for beef and were dying of Texas fever on the way, in the New York stock yards, and elsewhere. The question as to the effect of such diseased flesh upon human health was at that time entirely new and caused much uneasiness. The cattle commissioners of New York State and the board of health of New York City made a vigorous effort to check the importation of diseased cattle from the West, and to their efforts we owe much valuable information of this disease. During that year it was investigated by Dr. R. C. Stiles, for the Metropolitan Board of Health, and by John Gamgee and Drs. John S. Billings and Curtis for the National Government. Since then investigations have been made and published by Drs. D. E. Salmon and Detmers, for the United States Department of Agriculture, and by Drs. Frank S. Billings, Paquin, Dinwiddie, and Francis for the experiment stations of certain States. These various reports will be again referred to under the special subjects to which their authors have given more or less attention.

Perhaps the most important and special contribution to the subject since the earlier investigations of 1868 is the determination of the boundary line of the permanently infected district by Dr. D. E. Salmon. From what has already been stated it will be readily understood that this line marks the northern limit of the territory from which cattle may carry the infection into the territory north of this line. On the other hand, to cross this line from north to south obviously places cattle in the position to contract Texas fever under favorable conditions. The investigations of Dr. Salmon have shown that this permanently infected area does not extend north of the 37th parallel of latitude, excepting along the eastern slope of the country, where it extends halfway between the 38th and 39th parallels. The order of the Secretary of Agriculture, issued February 26, 1892, puts the following States and Territories entirely within the permanently infected area: South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas, Louisiana, and Indian Territory. The following are crossed by the boundary line, and are therefore not entirely within the infected area: Virginia, North Carolina, Tennessee, Oklahoma, and Texas. The line as at present defined begins at the Atlantic coast, passing westward on the 38th parallel, and follows the lower boundary of Maryland to the Potomac. It then passes westward across Virginia as far as the eastern slope of the Blue Ridge, which it follows in a southwesterly direction through North Carolina, thus exempting the cooler mountainous regions of these two States from permanent infection. It continues in a nearly westerly direction across the southern strip of western North Carolina and the southern portion of Tennessee. Across the Mississippi it follows the northern boundary of Arkansas and that of the Indian and Oklahoma Territories, and finally passes southward through Texas on or near the 100th meridian.

In addition to this work of accurately defining the territorial distribution of the infection, nothing has been done to add materially to the permanently valuable knowledge concerning this malady. Although attempts have been made to discover the cause they were not successful, as we shall be able to show. In 1889 the first systematic experiments were made by the Bureau of Animal Industry, and these were at once fruitful in the discovery by one of us of a peculiar microörganism in the red blood corpuscles which corresponds in every respect with what we should expect as the true cause. At the same time the other showed by field experiments that the cattle tick was somehow necessary to the transmission of the disease. These observations were fully confirmed in 1890. In the fall of the same year it was observed that when young ticks hatched artificially are placed on cattle there is a sudden extensive loss of red blood corpuscles, accompanied by fever, which could in no way be explained by the simple abstraction of blood. This discovery, at once followed up by additional experiments, brought to light the remarkable fact that Texas fever is caused by putting recently hatched cattle ticks on susceptible cattle. All these results were reconfirmed in the summers of 1891 and 1892.

These investigations have thus far brought to light two important facts: (1) The constant presence of a blood corpuscle-destroying microorganism in Texas fever, and (2) the transmission of the disease from cattle to cattle by the cattle tick. The various experiments and observations which have led to these results are embodied in the following report and appendix.

The subject of Texas cattle fever has been treated of in the following publications, which are referred to in the text by the number prefixed to each title:

(1) Transactions of the New York State Agricultural Society, 1867, part 2.

(2) Report of the Commissioner of Agriculture on the Diseases of Cattle in the United States. Washington, 1871. (Reports by Mr. John Gamgee, J. R. Dodge, and Drs. J. S. Billings and Curtis.)

(3) Contagious Diseases of Animals. Special Report No. 22. (Report by Dr. D. E. Salmon, pp. 98–142.)

(4) Report of the Commissioner of Agriculture for 1881–'82. (Report by Dr. D. E. Salmon, pp. 300–306.)

(5) Contagious Diseases of Animals. Washington, 1883. (Report by Dr. D. E. Salmon, pp. 13–44. Report by Dr. J. H. Detmers, pp. 103–145.)

(6) First Annual Report of the Bureau of Animal Industry, 1884. (Report by Dr. D. E. Salmon, Chief of the Bureau, pp. 214–221.)

(7) Second Annual Report of the Bureau of Animal Industry, 1885. (Report by Dr. D. E. Salmon, Chief of the Bureau, pp. 247–274.)

(8) Bulletin of the Agricultural Experiment Station of Nebraska, II, No. 3. (Southern Cattle Plague and Yellow Fever from the Etiological and Prophylactic Standpoints. By Franks S. Billings.)

(9) Texas Fever. By Paul Paquin. (Missouri Agricultural College Experiment Station, Bulletin No. 11, May 1890.)

(10) Third Annual Report of the Arkansas Experiment Station, 1890. (Report by R. R. Dinwiddie, Veterinarian, pp. 28–122.)

The Nature of Texas Cattle Fever.

PERIOD OF INCUBATION.

This term has no very definite significance in this disease, for it is used to designate different things. Thus it has been employed to indicate the period elapsing between the exposure of susceptible cattle to Southern cattle, or upon fields infected by them and the appearance of the disease. If taken in this sense it may vary from ten to ninety days. The great variation here observed is readily explained by the life-history of the cattle tick, with which this period is intimately associated. A discussion is therefore postponed until the life-history of this parasite has been described, and we content ourselves here by simply mentioning the facts as observed.

This term may also be used to signify the time elapsing between the introduction of the infectious agent into the tissues and fluids of the body and the first appearance of disease. This period is ascertainable by inoculation. In the case of subcutaneous and intravenous injection of blood from cattle suffering with Texas fever, the fever temperature appeared within a few days of the inoculation and outward signs of illness were manifest on or even before the sixth day. It is probable, therefore, that multiplication begins at once after the microparasite has been introduced into the body, and when it has attained a sufficient momentum the external symptoms of disease appear. This may be in from six to ten days, depending on the number of microparasites originally introduced, the predisposition and age of the animals, and the season of the year.

SYMPTOMS.

ACUTE TYPE.

In our experiments two types of disease have manifested themselves, the acute fatal type and a mild, rather prolonged, usually nonfatal type. As they differ in many respects, they will be considered separately.

The acute disease is the disease of the hot summer months. It appears suddenly, and as a rule at the same time in all animals of a herd which have been exposed to the same infection together. The fever usually precedes the outward symptoms by several days, and animals apparently quite well will show a high rectal temperature ranging from 105° to 108° F. The value of the clinical thermometer in thus detecting disease was pointed out by Gamgee and by the Metropolitan Board of Health in 1868. The latter have recorded a temperature of 109 F. (1, p. 1098.) A temperature above 108° F. has not been noted in our experiments. A glance at the table in the appendix will show that the normal morning temperature of the cattle in our experiments ranges from 100.5° F. to 102.5° F., being in general somewhat lower in autumn than in midsummer. The temperature of calves and young animals may rise to 103° F. without being accompanied by any signs of disease.*

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*These figures agree fairly well with those of other observers. "The temperature of healthy cattle ranges from 37.6° to 39.6° C. (99.7° to 103.3° F.). In some cases it may be even a trifle higher or lower. In the morning it is usually, but not invariably, 0.2° to 0.4° C. (0.4° to 0.7° F.) lower than at night. In calves and heifers it is usually somewhat higher than in old cows. * * * The general average from the results obtained by numerous observers is 38.8° C. (101.8° F.)."—Dieckerhoff (*Lehrbuch d. spec. Pathologie und Therapie f. Thierärzte, II.*) During very hot weather the evening temperature of cattle more or less exposed to the sun in the pastures of the station has been found to rise to 104° and even 105° F., although the animals were, so far as could be determined, in good health.

If the temperature of exposed animals be taken once daily, say in the morning, it will be found that at the outset of the disease it will rise within twenty-four hours from the normal to 104° F. or even higher. In the following twenty-four hours it may rise to 105° or 107° F. The continued daily record will then show a high temperature until the disease terminates fatally or in recovery. In the former case it may fall from 2° to 4° below the normal just before death. When recovery ensues it falls as quickly to or even below the normal as it rose in the beginning of the attack. If the temperature be taken twice daily, in the morning and the evening, a new set of phenomena appear. The temperature at the outset rises during the day, is highest in the evening, and may be low again in the morning. This oscillation, partly a normal occurrence, may be noticed for three or four days in some cases, the morning temperature gradually rising until it is as high as the evening temperature. The high temperature then remains continuous until the end of the fever. These facts are well exemplified in the diagram on the following page.

The fever may be detected by an experienced hand without a thermometer. The whole surface of the body feels hot to the touch. The heat is especially noticeable when the hand comes in contact with the anus or vulva in taking the rectal temperature. It is possible to go over a herd of cattle and select those having a high temperature by simply placing the hand on the anus.

The pulse and respiration rise with the fever. There is considerable variation in the number of the pulse beats and of the respirations during health, and there is also in some cases the excitement incident to being caught, which prevent our giving any very accurate figures. In health the number of respirations of the cattle used in our experiments may be put down as between 20 and 40 per minute, according to the temperature of the air and the age of the animal, while the pulse seems to range between 60 and 80 beats per minute.* In animals in the acute stage of Texas fever the respiration may rise to between 60 and 100, and the pulse to between 90 and 110. As the fever subsides and recovery begins the great weakness of the animal still keeps the pulse very high for a time, especially when the animal is moved about or excited in any way. The respirations, on the other hand, are apt to fall below the normal in this same period. When death approaches the heart-beats increase in number as they grow feebler, and the respirations fall with the body temperature below the normal. These statements are fully illustrated in the appendix by the individual cases.

Next to the high temperature the condition of the urine demands our attention. The one sign regarded as peculiar and pathognomonic in this disease is the discharge of urine having the color of blood. This color is not due to a discharge of blood from the kidneys and subsequent breaking up of the red corpuscles, but to a filtration of the coloring matter of broken-down red corpuscles (hæmoglobin) already in solution in the circulation into the urine in the excretory structures of the kidneys. This fact was first pointed out in 1868 by R. Cresson Stiles.

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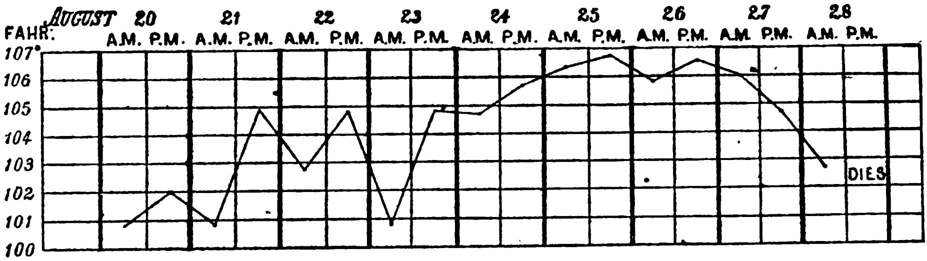
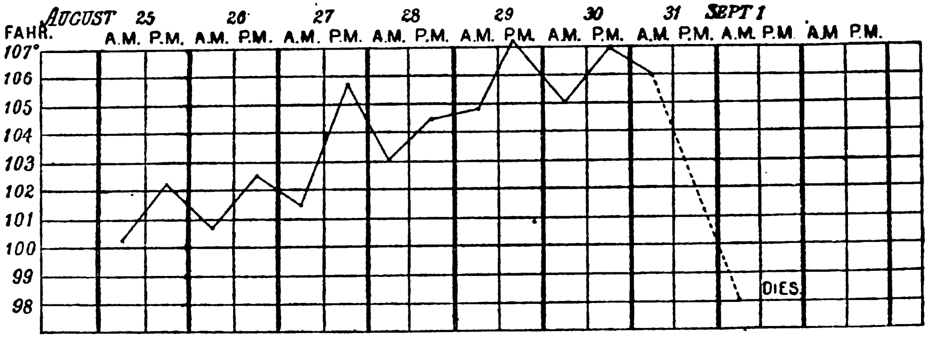
* The respiration in our cattle seems to have been higher than the normal of other observers. "Respiration in healthy cattle varies from 16 to 25 per minute, and may fall as low as 14 or rise as high as 30. According to the observations of Fürstenberg it is 21 per minute for cows and 24 for bulls."

The "pulse, like the respiration, varies greatly. According to Hering and Fürstenberg it is from 90 to 130 per minute during the first two weeks of life; from 70 to 80 from two weeks to two years. The average for a full-grown animal is 60, for old cows 50 to 55."—*Loc. cit.*

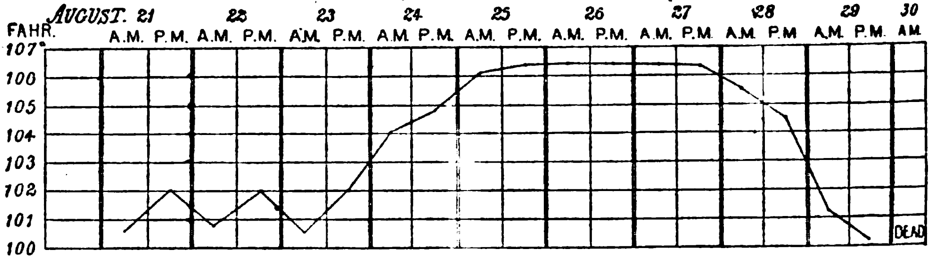
No. 80. FIELD II (TEXAS CATTLE WITH TICKS) 1890.



No 128. FIELD II (TEXAS CATTLE WITH TICKS). 1890.



No 129. FIELD II (TEXAS CATTLE WITH TICKS) 1890.



No 186. INTRAVENOUS INJECTION OF BLOOD FROM A CASE OF DISEASE - 1891.

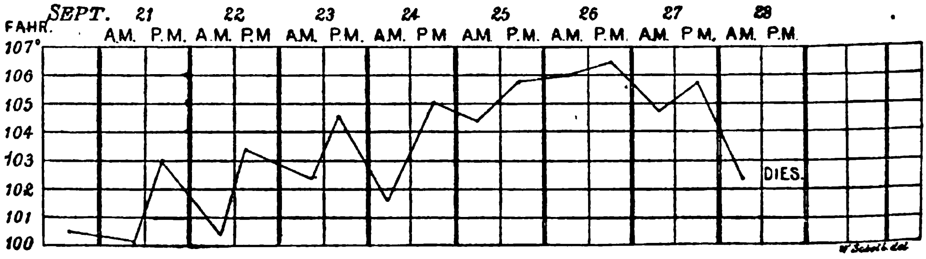


FIG. 1.—Temperature curves in four cases of Texas fever.

In using the term hæmoglobinuria this is all that is meant in this report. The precise state or condition of this coloring matter in the urine does not call for consideration.

Hæmoglobinuria may be said to be present in most acute fatal cases of Texas fever. Out of 46 fatal cases in which urine was in the bladder after death, hæmoglobin was present in 33 cases. In 13 negative cases the animals were killed in the earliest stages of the fever, or else they died or were killed after the number of blood corpuscles had been greatly reduced and the acute stage of the disease was over. In the former cases the hæmoglobin had not yet been set free from the corpuscles; in the latter cases it had probably been eliminated one or more days before death. How frequently "red water" is passed before death we can not state with any degree of certainty, since its discharge may wholly escape observation. We have a record of hæmoglobinuria in but four cases: in No. 43 on the third day before death, in No. 44 on the fourth day before death, in No. 80 before it was killed (probably twelve to twenty-four hours before death), and in No. 198 twenty-four hours before death. In some of these cases it so happened that the urine was passed while the animal was undergoing examination. It is interesting to note in connection with the statements made that in No. 44 no "red water" was found in the bladder after death, although it had been passed four days previously.

Whether hæmoglobinuria is always present in acute cases of Texas fever it is impossible to state definitely. As it seems to depend upon the rapidity with which the red blood corpuscles are infected and destroyed, a slower destruction may allow other organs to take charge of the débris and thus forestall the discharge of hæmoglobin in the urine. We have observed hæmoglobinuria in but one acute case which recovered, while in a number of cases in which the urine was collected, sometimes in the height of the fever, sometimes after it had departed, no hæmoglobinuria was detected. In this solitary case the high temperature first appeared August 18. On August 23 the temperature being still above 105°, the urine was free from hæmoglobin, but contained a small quantity (.05 per cent) of albumen. On August 27 the temperature had become normal, but a second paroxysm followed soon after, and on September 4 and 5 the urine was of a port-wine color. Urine collected September 6 was again of normal color.

The urine during the fever, when free from hæmoglobin, contains in many instances a small quantity of albumen. The specific gravity may at first be high (1030–1040), and it may be strongly alkaline and effervesce with acids as in health, but, as the disease progresses and when the animal eats but little, its specific gravity will fall to 1010–1020; it fails to effervesce with acids and is faintly alkaline or even slightly acid. When the fever has subsided the urine has been observed to be in a few cases very watery, *i. e.*, of very low specific gravity and feeble in color. Within one or two weeks, however, the normal condition is restored.

The urine which contains the coloring matter of the blood varies, as might be expected, very much in depth of color, according to the concentration of the hæmoglobin. It may have a very light claret color, or it may be so deeply tinted as to appear opaque and blackish. In a test tube when viewed by transmitted light it may barely permit the light to pass unless diluted with water. (See Plate III, Fig. 4.) Such urine is, as a rule, entirely free from suspended matter and blood corpuscles. The latter may sometimes be found in small numbers when the urine is permitted to stand, and they may be derived from small hemorrhages in the pelvis of the kidney, quite regularly observed at autopsies. The coloring matter, as has been stated above, is derived from corpuscles broken up within the circulation, and not outside in the bladder. When such urine is treated with a little acetic acid a brownish flocculent precipitate, probably of the derivatives of hæmoglobin, appears. When boiled, a brownish flaky precipitate forms, which rises to the surface as a scum. As might be expected, such urine always reacts in presence of the usual tests for albumen. How much of the precipitate formed is the ordinary serum-albumen found in various forms of kidney disease and how much belongs to hæmoglobin does not come up for consideration here. Suffice it to say that in very opaque urines the precipitate is quite abundant and corresponds when Esbach's test is applied, to from 1 to 3 per cent of albumen.*

The subject of hæmoglobinuria is more fully discussed here under the symptoms because it is occasionally observed during life and probably with the aid of a catheter may be seen much more frequently. The causes of its occurrence and the way in which it is brought about will be discussed in connection with the microörganism. Very little need be said of the other characters of "red water." When found in the bladder after or collected shortly before death its specific gravity is usually low (1010–1020) and it is feebly alkaline or acid. There is no effervescence with acids. After standing, a few granular casts and rarely urates are found in the very slight sediment. The greater the number of days before death that it is collected the more nearly it approaches normal urine as regards specific gravity.and alkalinity.

The bowels are as a rule constipated during the high fever, and on post-mortem examination the large bowels (cæcum and colon) are found in some cases compactly filled with small, very firm, hard balls of dung. As the fever subsides the feces again become softer and are then found more or less deeply tinged with bile.

Loss of appetite always, and cessation of rumination usually, accompany the high fever after the third or the fifth day. These, together with the enormous destruction of the red blood corpuscles and the temporary disorganization of some of the vital organs, lead to a rapid loss of blood during the fever and even to extreme emaciation during the period following the fever. Some observers have recorded the sudden and partial cessation of milk secretion. We have had no opportunity to observe this symptom.

Symptoms referable to disturbances of the brain and the spinal cord were rarely noted. They usually manifested themselves in partial loss of vision, delirium, staggering gait, and swaying of the hind quarters. These latter may in part be referred to the great weakness which cattle manifest after some days of fever and perhaps to the œdema around the kidneys. This weakness may become so great that they will be unable to rise even when urged. When standing there may be noted a trembling of the muscles, especially of the hind quarters and limbs. Icterus or jaundice has not been noted in any case during life.

Another character of this disease, the most constant and valuable of all, and of which the hæmoglobinuria or "red water" is but a part, is the thinness of the blood. A more thorough discussion of its condition will be given further on. In this connection we only mention those phenomena which can be witnessed by the naked eye. Soon after the high temperature sets in, the blood begins to grow thin, and after some days of fever it has become very pale and watery. An incision into the skin readily shows this to be the case. The difference between the drop of rich red blood issuing from a slight cut of the skin in healthy cattle, and the thin, pale drop oozing from such a cut in Texas fever, is very marked. This difference is due to the loss of red corpuscles, which give the blood its characteristic color. Associated with this there may be in some cases a marked bloodlessness of the skin in the later stages. A number of small incisions are often required to obtain a few drops of blood. In some cases shortly before death the blood slowly trickles from a slight incision for some time before it is checked by the natural process of coagulation.

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* If a few drops of acetic acid be added to urine holding much coloring matter in solution and allowed to stand over night, a clear yellowish liquid may be filtered off which gives the ordinary reactions for albumen.

When freshly-drawn blood is allowed to stand the serum forced out of the clot has in the acute stage a very dark-red color, indicating the presence of much coloring matter in solution. As regards the coagulability, which some observers have regarded as feeble, we have no facts pointing in one direction. In a few cases the coagulation appeared retarded; in others it appeared to be normal in rapidity and effectiveness. As will be seen further on, the condition of the blood must vary considerably from time to time. At one time it may contain the débris of destroyed corpuscles equal in number to one-tenth, or even one-fifth, of all circulating in the body. That under such circumstances its coagulability may be affected is evident. Frequently, however, the blood comes under observation when the destruction of red corpuscles has ceased and the products have either been excreted or metamorphosed. In this way conflicting observations may perhaps be harmonized. In general, we may say that the coagulability of the blood is not much altered.

We have thus briefly sketched the symptoms of an acute attack of Texas fever and noted three important diagnostic features, high temperature (or fever), hæmoglobinuria (or red water), and thinness of the blood (or destruction of red corpuscles). The last is the most constant, and, in fact, the one essential character of Texas fever. Among the other less important symptoms and appearances, many of which are always associated with one or the other of those mentioned, are dry, hot skin, high rate of pulse and respiration, loss of appetite, cessation of rumination and of milk secretion, constipation, hyperæmia followed by bloodlessness of the skin and mucous membranes.

The course and the duration of the disease are subject to variations. We have seen that it begins somewhat abruptly with a high temperature, runs its course in a few days, and terminates fatally, or else it disappears as quickly. In the latter case the disease is followed by a period of great debility, owing to the impoverished condition of the blood and the degenerative processes set up in the various vital organs, and not infrequently by relapses. Some animals never fully recover; in others recovery takes place after weeks and months.

The duration of the disease varies more or less, but the continuous high temperature rarely lasts longer than eight to ten days. The fatal termination may take place in the height of the fever—that is to say, four or five days after the appearance of a high morning temperature, and may be the direct result of the derangement of the vital functions, due to the rapid destruction of red corpuscles by the microörganism, or it may take place after the fever has subsided, when the animal fails to rally from the shock imparted to the system and from the drain of its blood-forming resources. If we take as our starting point of the fever the first high morning temperature death may ensue from four to fourteen days thereafter, or it may be delayed still longer, when the animal dies slowly of exhaustion. The period of disease for such as recover is practically the same. A fever period of eight to ten days is followed by a period of normal or subnormal temperature. The falling of the temperature marks the end of the destruction of red blood corpuscles and the disappearance of the parasite from the blood. The subject of relapses and secondary attacks during the season by which the period of disease as a whole may be prolonged into months is discussed further on.

The mortality from Southern cattle fever varies greatly, as will be seen in the following pages on the mild chronic form of the disease. The time of the outbreak will largely decide whether practically all the attacked animals die or all survive. A midsummer outbreak, when acute in its nature, is the most fatal. From this there may be all gradations toward the mild, nonfatal form of late autumn.

MILD, NONFATAL, OR CHRONIC TYPE.

This type of Southern cattle fever has hitherto remained unobserved. The reason for this is quite simple. It can be recognized only by an examination of the blood, which must determine the presence of the microparasite in the red corpuscles and their approximate rate of destruction.

The mild form of Texas fever is largely a disease of autumn, after the heat of summer has passed away. In the latitude of Washington, D. C., October and November, rarely the first week of December, are favorable to it. It is not, however, strictly limited to this period, as it may be observed from early August on through the entire season. Its occurrence during this latter period, which is commonly characterized by acute disease, is limited largely to the less susceptible calves and to a very few of the exposed adults. Cattle which have passed through the acute disease may have a relapse in the form of the mild type in autumn.

The essential difference between this and the acute type rests on the fact that a stage of the parasite circulates in the blood of the mild cases, which is different from the one observed in acute cases. This difference will be made clear in the chapter on the Texas fever parasite. When we come to the various symptoms there is only a difference of degree. The fever temperature is low and fluctuating, rarely rising above 105° F. in the evening. In the morning the temperature is usually normal or very slightly elevated. The destruction of red blood corpuscles by the microparasite goes on as in the acute form, but much more slowly and deliberately, and hence the period of disease itself—that is, the time during which the parasite is present in the blood in considerable numbers—is much prolonged. The hæmoglobinuria is probably never present. The various symptoms which accompany the fever are only present when the temperature is above 103° F. There is loss of appetite and dullness, especially when the number of red corpuscles has reached its lowest limit, followed by a slight falling away in the condition of the animal.

It will thus be seen that there are no symptoms manifest to the unaided eye which we might put down as characteristic of Texas fever in its mild type. It might be confused with a variety of disorders incident to the bovine species or else be entirely overlooked. From an economic point of view it is of not very great consequence, since it is not fatal, and the loss in weight, though quite considerable in some cases, is soon made up in the winter months.

THE RELATION BETWEEN THE ACUTE AND THE MILD TYPE OF TEXAS FEVER—RELAPSES.

In certain cases it was noticed that after the animal had recovered from the acute attack, and the number of blood corpuscles had nearly reached the normal maintained before the attack, it would again fall, and in the blood many corpuscles could be found containing the small stage of the Texas fever parasite which is always associated with the mild type. In other words, the acute attack would be followed after a certain interval of time by a mild attack. This interval may vary considerably. Thus, in one case the acute attack began early in August, and the secondary, or mild attack, about one month later. In another the acute attack began early in September, the mild attack about three weeks later. In a third, the acute attack began near the middle of August; the mild attack was observed in the second week of October. Two cases of Texas fever, induced by the intravenous injection of blood, are particularly noteworthy in this respect. In one the disease began July 13, in the other, July 23. In both the mild attack was detected at the same time at the end of August, although it may have begun some days before.

The question naturally presented itself whether these secondary attacks are simply relapses or whether they are reinfections from without. As will be fully discussed further on, the young cattle tick induces the disease in natives as soon as it has attached itself to their skin. Since the cattle ticks are present on the infected field during the entire summer and autumn it is reasonable to suppose that the secondary or mild attacks may be caused by ticks which have remained on the field or by the second generation, since the usual time for mild attacks, late September and October, is the time for the appearance of a second generation of young ticks. Whether these mild attacks are always due to an invasion of the animal by such a second generation, or whether they may be due in some cases to the recrudescene of the microörganism not yet entirely eliminated from the system, was settled by the two cases above referred to. Since they were inoculated but once, and there was no opportunity for reinfection, these cases prove that a mild attack may follow an acute attack without a fresh importation of the microörganism from without; in other words, that the mild attack may be considered as a relapse. The conclusion does not operate against the probability that some mild attacks may be due to secondary infection from without.

In addition to the true relapses just referred to, we may observe more or less oscillation in the course of the disease as expressed by the destruction of red corpuscles. This oscillation is probably dependent on the periodical multiplication of the microparasite, and in this respect may be regarded essentially identical with the relapse. The latter follows the primary disease at long intervals, while the oscillations are but one and one-half to two weeks apart as a rule. Neither the relapses nor the oscillations have been marked by any distinctive clinical signs excepting a slight rise of temperature in some instances. Such undoubtedly do exist, and may perhaps be detected by more frequent daily measurements of the temperature and a closer and more frequent examination of the animals and their excretions than our time has permitted us to make.

PATHOLOGICAL CHANGES.

In dwelling upon the pathological changes caused by Texas fever we have had two objects in view: first, to add as much as possible to the information already on hand, and, secondly, to furnish such a complete record of the cases in the various experiments that there would be no room for doubt in the reader's mind that we were dealing with Texas fever wherever this is claimed to be so. Inasmuch as the causation or etiology was the essential object of the researches, everything else had to be subordinated to lines of investigations which endeavored to get at the causes and the modes of transmission of the malady before us. The following account, though somewhat meager for this reason, is given as a description of the nature of the disease we were dealing with. We may note here that the lesions induced by North Carolina cattle and those induced by Texas cattle at the same season were identical in every respect.

CHANGES IN THE ORGANS AND TISSUES.

Cattle which have succumbed to Texas fever undergo post-mortem changes very rapidly. This may be largely due to the fact that the disease occurs in the greatest heat of summer. Hence facts relating to the appearance of organs and tissues are of doubtful value if the animal has not been examined soon after death. This occurs as a rule during the night, and post-mortem changes are begun when the morning arrives. It is frequently desirable, therefore, to kill animals in different stages of the disease to obtain trustworthy facts.

The skin presents nothing abnormal to the unaided eye, and, as will be pointed out later on, certain regions are beset with ticks. In one case which came to our notice very recently the hair on the abdomen and the inner aspect of the thighs was matted into little tufts by dried blood. The skin showed at such places a bluish elevated spot, and when incised a little blood was found in the subcutis. This may be what has been called blood sweating.

The subcutaneous tissue and fat in our cases were free from any changes except in three, in which they were of a decidedly yellowish tinge. Jaundice was thus of rare occurrence. In the report of the Metropolitan Board it is stated that "the fat has a deep or high colored greenish appearance and has not the firm resistance of health. The lean meat is of a brownish mahogany color, and on being cut into has a peculiar sickening odor." The muscular tissue in our cases was normal in color or perhaps a trifle paler. Œdema of the subcutaneous tissue of the ventral aspect of the body was occasionally present and referable to the debilitated condition of the animal.

The brain was removed in a small number of cases and carefully examined, but no lesions which can be regarded in any sense as peculiar to or characteristic of the disease were observed. It may be said, in general, that the brain shared the general tendency towards the injection of the capillary system. The vessels of the pia and the plexuses were engorged, and over the frontal lobes and near the great transverse fissure it was more or less pigmented—a condition also met with in other diseases. The gray matter of the cerebrum and especially of the cerebellum appeared of a more pinkish color. The white substance was normal in color, the ventricles free from fluid.

Lungs.—The lungs are, as a rule, healthy. There is, in many cases, pulmonary œdema, with or without emphysema, noticeable after death. In a few instances foci of dark red hepatization were observed in one of the principal lobes, which involved one or several lobules.

Heart.—At the autopsy the right ventricle is always distended with blood, fluid or clotted, according to the time elapsing between death and the examination. The left ventricle is usually firmly contracted, and may contain a small quantity of fluid or clotted blood. The clots are quite firm and very rarely mixed with firmer, pale yellowish clots.

A very constant lesion is the extravasation of blood beneath the epicardium and endocardium. This is mainly restricted to the left ventricle, although petechiæ are not infrequently met with on the right ventricle. On the external surface of the heart the petechiæ are usually grouped along the interventricular groove and near the base, although cases occur in which the whole ventricular surface is sprinkled over with them. The inner surface of the left ventricle shows larger patches of extravasation usually on, or at the base of, the papillary muscles. On the large vessels at the base of the heart, within the pericardial sac, there are frequently very delicate shreds of tissue or patches in a hyperæmic condition. The heart muscle, on closer inspection, is observed to have its minute vessels markedly injected, and in fresh sections the capillary network is found densely packed with red corpuscles. In cases which have succumbed after the subsidence of the fever the heart muscle is quite pale. Cloudy and fatty changes of the fibers are in some cases quite marked; in others absent or restricted to a small number of fibers.*

Lesions of the abdominal cavity are not infrequent. Œdematous conditions are quite common around the kidneys and will be referred to again. Gelatinous œdemas are sometimes encountered in the portal region between the duodenum and liver. The omentum frequently displays peculiar hyperæmic patches, consisting of delicate shreds of vascular tissue made visible to the naked eye by the injected condition of the blood vessels.

Spleen.—That this organ in Texas fever is very much enlarged was commented upon by the earlier observers, and the name "splenic fever" took its origin from this condition. Gamgee, in 1868, caused to be weighed the spleens of a large number of native Western cattle, of Cherokee cattle (supposed to have come from the Indian Territory), and of Texan cattle. These animals were considered healthy and fit for human consumption.

The average weight of the native Western spleen was 1.45 pounds; of the Cherokee spleen, 1.94 pounds; of the Texan spleen, 2.5 pounds.

A number of spleens were weighed at one of the Washington abattoirs to determine the normal weight. The result is given in the following table:

Date.	Weight of steer.	Weight of spleen.
	Pounds.	*Pounds.*
October 10, 1890 .... No. 1..	950	1.75
Do .... No. 2..	900	1.75
Do .... No. 3..	1,000	1.90
Do .... No. 4..	1,000	2.37
Do .... No. 5..	1,000	1.50
October 15, 1890 .... No. 6..	1,300	2.25
Do .... No. 7..	1,100	1.75
October 22, 1890 .... No. 8..	1,400	2.00
Do .... No. 9..	1,300	1.90

The source of these animals was not determinable. It will be noted that the weight varies considerably, although in all the appearance of the organ, both as to its capsule and pulp, was the same. The weight of each animal was estimated by the butcher in charge. These examinations were made at a time when any destructive influences of the summer on the blood may not have been entirely neutralized. How far the bleeding of the animals at the time of slaughter may have affected the weight of the spleen in comparison with that of cattle which succumbed to the fever with the blood in their system it is of course impossible to estimate. By taking the average of the above nine cases, the weight of the spleen of a steer weighing 1,000 pounds would be 1.72 pounds.

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* An interesting appearance, which may now and then deceive observers, is the presence, under the endocardium, of minute whitish, fusiform bodies, perhaps one millimeter long, which seem to follow the course of the superficial veins and rest upon or near their walls. They are sarcosporidia (psorospermia) cysts filled with falciform bodies. These cysts are likewise present in the depths of the heart muscle and in the skeletal muscles. Under the endocardium their number is greatest in old cows. They are in some cases so numerous that fifty may be included in an area of a square centimeter. They are easily removed entire by careful teasing.

The weight of the spleen in Texas fever varies considerably, according to the stage of the disease in which the animal succumbs. Animals which die after some days of high fever have usually the largest spleens, although this is not an invariable rule. If we compare the weights of spleens as given in the appendix under many of the cases it will be seen that in acute cases the spleen is generally from two to four times its weight in health.

If we turn for a moment to examine its appearance we find its general shape unaltered, but the ordinarily rather thick whitish capsule very much distended and attenuated, so that the dark pulp shows through it very distinctly. (Plate I.) The veins of the capsule are distinct, the minute vessels markedly injected and occasionally accompanied by extravasations of blood. The organ is firm to the touch, owing to its distended condition. When it is incised, the pulp appears as a dark brownish-red, glistening, homogeneous mass, which has been compared to "blackberry jam" in its appearance. The usual markings of the parenchyma of the normal spleen are effaced. The grayish Malpighian bodies and the whitish trabeculæ have all disappeared from view within the distended pulp. (The differences between the cut surface of the spleen in health and in Texas fever are well brought out on Plate I.) The pulp may be still firm, or it may be partly diffluent, welling out as a semifluid mass from the incised retracting capsule. It has occasionally been reported as ruptured, but this may be a combination of post-mortem softening with carelessness in its extraction. In some cases the spleen may be much heavier than in health, but its markings still visible on section.

A microscopic examination shows that the enlargement and peculiar color of the spleen tissue is due to an engorgement with red blood corpuscles. With this engorgement there may be associated a variable number of large cells containing coarse granules and from two to twelve red corpuscles, or else the remains of these corpuscles in the form of irregular clumps of yellowish pigment. The pigment is also free in masses of variable size. Examination of fresh pulp from spleens of healthy cattle showed that the presence of large quantities of free pigment of the form described is not uncommon.

Of all the organs *the liver* is the most seriously involved (See Plates II and III.) The enlargement, congestion, bile-injection, and fatty degeneration were pointed out by R. C. Stiles in 1868. Gamgee limited himself to matters of weight, and evidently did not observe the extensive changes which the parenchyma underwent. In our own observations of healthy and diseased livers, the latter were probably from 3 to 5 pounds heavier than the former. The edges were well rounded off. The color of the surface was usually paler than in normal livers, and in most cases of a peculiar mottled appearance. The mottling was due to minute irregular grayish-yellow patches usually 1 millimeter or less in diameter. When incised the parenchyma was remarkably bloodless in most cases, and a lac-colored, thick blood poured from the cut ends of the larger hepatic veins. The color of the cut surface was either a uniformly brownish yellow or else mottled as on the surface. (Plate II, Fig. 1.) The mottling, on closer scrutiny with the naked eye or hand lens, was found to be due to a paler yellowish discoloration of the zone bordering the intralobular veins. (Plate II, Fig. 2.) This zone of discoloration was the wider the more prolonged the disease, and in a few cases involved the entire lobule. Parallel to this degenerative process the consistency of the organ became less resistant, more doughy, and brittle.

In thin sections of fresh tissue* the most striking phenomenon was the filling up of the ultimate bile canaliculi, so that the hepatic cells were inclosed in polygons of yellow lines forming a beautiful network. (Plate III, Figs. 1 and 2.) When the liver is teased and crushed the contents of these bile canaliculi may be found floating free in the form of rods, sometimes with Y-shaped ends. (Plate III, Fig. 3.) This stasis or filling up of the ultimate bile capillaries was present in nearly all animals examined. It was most pronounced in those whose death followed quickly after a high fever. In one case purposely killed in the early days of the fever the liver was the seat of marked congestion, the bile-stasis not having taken place yet. The extent of this stasis varies considerably. It may be seen in small isolated areas or else it may involve a large continuous territory. Owing to absence of connective tissue between the lobules it is quite impossible in fresh sections to make out accurately its distribution. It seems to be most frequently met with in the innermost or hepatic zone of the lobule (Plate III, Fig. 1; Plate II, Fig. 4), but it may also be found involving the entire lobule. Small bile ducts between the lobules are often found injected, and rarely lines of yellow injection may be visible to the unaided eye.

Associated with the occlusion of the biliary canaliculi and ducts is a more or less extensive fatty degeneration of the hepatic cells. This is most advanced in prolonged cases of disease. In several which came under our observation the fatty changes were so extensive that cells free from large quantities of fat could not be seen. Among other abnormal appearances may be mentioned the presence of irregular yellow clumps of pigment in the hepatic cells, and of stellate masses or blood-red needle-like crystals (Plate III, Fig. 2) of very minute size (hæmoglobin?). In one case large-branched thrombi were found in some of the hepatic veins.

The pathological changes observed in sections and teased preparations of fresh liver tissue are more accurately interpreted in sections of tissue hardened in Müller's fluid and in alcohol. The material was imbedded in paraffin after having been passed through chloroform paraffin. Sections cut in this way were far more serviceable than those cut in alcohol. The injection of the bile canaliculi is seen only in Müller's fluid preparations or in alcoholic material cut directly without imbedding. The extent and location of the injection are variable. It may appear over an entire lobule or only a small portion of it. The fatty degeneration so regularly seen in fresh material shows itself in sections of hardened material in a peculiar vacuolated appearance of the cell protoplasm, the fat having been dissolved out. The vacuolation may be more pronounced near the center of the lobule, where the individual vacuoles may be as large as red corpuscles. Of these there may be several in a single cell, very little of the plotoplasm remaining. The cell protoplasm of the peripheral zone of the lobule is uniformly vacuolated, the vacuoles being very small.

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* These were usually made with a razor, and examined in iodized serum. The freezing microtome was not generally used, because it was desirable in this examination to preserve the red corpuscles.

Another change that is of considerable importance in estimating the pathological effect of the disease is a tendency toward necrosis of the inner zone of the lobule. This process, which shows itself to the naked eye as a faint paler mottling of the liver tissue limited to the inner zone of the acini, seems to begin around the central vein and extend toward the periphery.* It is characterized by a degeneration and loss of the nuclei of the parenchyma cells. These changes are observable with various stains, such as hæmatoxylin, alum carmine, and the anilines (alkaline methylene blue, aniline water-methyl violet, etc.). Ehrlich's acid hæmatoxylin, with or without eosin, is a very satisfactory dye, owing to the intensity of the nuclear staining. The changes undergone by the nuclei are at first manifested by a feebler stain. The margin, which may be irregular, is stained, but the body of the nucleus is pale, and usually contains several deeply stained round bodies simulating nucleoli. Later on these bodies are all that is left. They shrink together or even unite into a small irregular deeply stained mass. The cell protoplasm is much more feebly stained than in normal areas and its outlines are indistinct. This nuclear degeneration may appear in a compact area uniformly, or we may find all grades of degeneration intermingled.† In tissue undergoing such changes the central portions of each lobule may appear much paler than the peripheral. The trabecular arrangement of the cells may be exaggerated by a widening of the lumen of the capillaries in the periphery and made indistinct or become obliterated in the central portions. The destructive changes in central regions may go on to a complete loss of the nuclei. This appears very well in methylene-blue stains. The necrotic portion refuses to stain at all, and the result is a mottled section with the isolated unstained areas inclosed in an irregular network of stained material very striking even to the naked eye. Such mottling will, of course, appear with other stains, but not so distinctly. The extent of the necrosis may be as much as one-third or one-half of the entire volume of the lobule.

In endeavoring to account for the fatty and necrotic changes of the parenchyma we think it probable that the bile stasis, by plugging up with solid bile the ultimate bile canals, may interfere in some way with the nutrition of the parenchyma, or exercise upon it some deleterious influence through the stagnating bile, and thus set the degenerative processes in motion. The bile stasis is undoubtedly due to the breaking up in the capillaries of the liver of immense numbers of infected corpuscles. A large amount of débris is thus brought to the cells for transformation into bile. The result is an abnormal fluid containing a superabundance of solids (pigment) which is unable to flow in the bile channels. How far the degenerative process may be aided by any plugging of the capillaries with infected corpuscles it is impossible to state. In fact, the relation of the disintegration of the red corpuscles and of the bile stasis to the fatty degeneration and the necrosis around the central vein should be made the object of special pathological study.

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*One may be at a loss to determine the limits of the lobules in the ox, owing to the absence of any complete connective tissue boundary. In stained sections they are readily made out by taking as a guide the connective tissue with its numerous stained nuclei in the spaces in which the interlobular vessels and ducts pass.

†J. H. Detmers (5, p. 137) observed, in 1883, the disappearance of the nuclei and the reticulated appearance of the cell protoplasm. Babes, in 1889, described a similar condition in Roumanian cattle affected with infectious hæmoglobinuria.

Bile is found in the gall bladder in considerable quantity (one-half pint to a quart) after death. As might be anticipated from the description of the changes in the liver, this fluid is greatly altered. The usual limpid greenish fluid is replaced by an almost semisolid mass. As it flows from the incised bladder it has been aptly compared to chewed grass. The presence of mucus makes it cohesive enough to be drawn out into long flat bands as it flows. When it is allowed to stand quietly in a cylindrical vessel a layer of flakes settles down which occupies not infrequently one-half of the entire column. The supernatant fluid is much darker than normal bile. The suspended matter appears to be made up chiefly of small yellowish flocculi or flakes. A deep yellow tinge is imparted to all vessels and to the hands coming in contact with it. When examined under the microscope the suspended particles are resolved into amorphous yellowish masses mingled with bright golden points barely visible at 500 diameters. The common bile duct has always been found pervious, and in many cases an abundance of bile is found in the small intestine.

The kidneys.—We have in a preceding chapter referred to the condition of the urine in this disease, and have found it altered by the presence of certain abnormal products—hæmoglobin and albumin. We might therefore anticipate more or less alteration in the secreting organs, the kidneys. In a considerable number of cases a sero-sanguinolent condition of the connective tissue and fat about the kidneys is observed. In a few cases the ventral surface of the organs appeared like two large blood blotches. The portion of the abdominal wall upon which the dorsal surface of the kidneys rests is free from these effusions.

The kidneys themselves, like the other organs affected by this disease, vary more or less in color, according to the severity and stage of the disease. In those cases which succumb early in the fever, and in which the bladder is filled with port-wine-colored urine, the kidneys are enlarged and of a uniform dark brownish-red color throughout. The usual markings are pretty well effaced. When fresh sections are examined from different regions, the vascular system is found quite uniformly engorged and distended with red corpuscles. The section is likewise sprinkled over with very minute pigment particles. Sometimes irregular masses of red corpuscles, run together as it were, are met with in the vessels of the pyramids. Lesions of the secreting structures are not discoverable. Hemorrhages are uncommon. In those cases which succumb after the hæmoglobinuria and the fever have passed away, the kidneys are paler than usual and the texture is quite flabby. Sections of the fresh tissue show in the cortex a considerable amount of pigment. In some cases the convoluted tubules are the elected seat of pigment deposit, and the epithelium of these tubes may be so filled with yellowish red pigment that they are easily traceable in their windings by their decided color. Fatty changes are occasionally met with in the epithelium, and the straight tubules of the pyramids may be filled with fat globules. Degenerative or necrotic changes of the epithelium were not noticed in sections of hardened tissue from a few cases stained in various ways. In those cases in which the capillaries were filled with red corpuscles, the latter were usually all infected with Texas fever parasites.

The pelvis and its ramifications were usually found beset with blood extravasations. It has already been remarked under the head of symptoms that in most cases the bladder is found containing from one to four quarts of urine holding more or less hæmoglobin in solution. Under the same head will be found a full discussion of this phenom.

enon, so that it need not be touched upon here. The bladder itself may show a few ecchymoses on its inner surface.

Digestive organs.—The upper portion of the digestive tract, including the paunch and reticulum, is generally free from morbid changes. The third stomach or manyplies was, in a few cases, somewhat "impacted;" that is, the contents were firm and rather dry, and the superficial layer of epithelium of the lining membrane tended to peel off. In most cases it was normal. The fourth or true stomach (abomasum) shows not infrequently a hyperæmic condition. In some cases the laminated portion was of a uniformly bluish-pink color. Both Gamgee and the Metropolitan Board of Health of New York City have laid much stress upon the lesions observed in this organ. Gamgee describes in addition to the general hyperæmia three kinds of lesions of the laminated, cardiac portion. He finds in some cases petechiæ, "resembling flea-bites" in some respects, whose "center is dark and sometimes softened and perforated." In others "the reddened folds are studded with minute yellowish-gray granulations due to a change in the epithelium, which becomes swollen and has a tendency to drop off. Each granulation does not usually exceed the size of a pin's head. This appearance is most marked where the folds are most congested, and in some cases where the congestion is slight it requires a somewhat careful inspection to recognize the presence of this change." The third lesion is described as follows: "Scattered throughout the folds, especially near their free edges, we find * * * marked erosions, as if the epithelium had been peeled off with a sharp finger nail."

The lesion described as the second was also present in many of the cases recorded in the appendix. Its constant appearance was very puzzling and might readily lead one to suspect some relation to the disease. Many of the granulations had their center perforated so that they suggested the presence of enlarged glands with hyperplasia of the tissue surrounding the mouth. It was not until the fall of 1890 that the nature of these little elevations was solved. In an animal killed for some purpose, though free from the disease, marked lesions of the mucous membrane of the fourth stomach were found. These consisted of yellowish-white exudations about as large as split peas, viscid and composed of round cells mixed with mucus and associated with the mouth of these elevated spots. A careful microscopic examination of this exudate showed the presence of a very minute nematode, a strongyle, imbeded in the exudate. That this was the cause of these lesions was soon determined. Some sections of the fourth stomach of a case of Texas fever in which these lesions were present had been prepared some time ago, but had not been studied, for want of time. These were now examined, and in the minute pits corresponding to the perforation in the center of these granulations the worm was seen coiled up at the base of the epithelial layer. It was also recognized as the worm found and described a few months before by Ostertag in cattle slaughtered in Berlin, Prussia. The worm described by him was larger, but the fact that it produced the same lesions made it highly probable that the two strongyli are of the same species.* This disposes of the second lesion seen by Gamgee. As regards the first, it is not unlikely that it represents the earliest stage of the invasion of the mucous membrane by the worm, but we will not be dogmatic on this point.

As regards the erosions, it may be said that in a small proportion of

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*Ostertag named the worm *Strongylus convolutus*, but this was changed by Dr. C. W. Stiles, of this Division, who gave some attention to the worm subsequently, to *Strongylus Ostertagi*. Journ. Comp. Med., 1892, p. 147.

our animals, irregular, very shallow, flattish excavations of the mucous membrane were found which had a blackish base. They varied much in size, some being quite small. They were most numerous on the laminæ. Some were occasionally encountered in the pyloric portion. After finding these same erosions even quite abundantly in some healthy stomachs from an abattoir we interpreted them simply as traumatic erosions due to the accidental presence of some foreign body.

In the investigations of the Metropolitan Board in 1868, the pyloric portion of the fourth stomach was found in many cases to contain deep, ragged excavations with hemorrhagic base. It is not improbable that at least some of these may have been the result of vascular occlusion, since in the animals examined at that time there seems to have been, so far as the descriptions and illustrations go, much more congestion of the fourth stomach and intestines than in our own cases. These erosions were extensive in but one case of ours. Their constancy led Moreau Morris in his report to the Board to consider them as a more certain indication of Texas fever than the other lesions commonly present. With this we can not agree. In fact we regard the digestive lesions as perhaps the least pathognomonic of the disease.

In a few cases affected with a more or less chronic after disease, there was much œdema of the coats of the fourth stomach, extending also to the mesentery.

The lesions of the intestines are limited to hyperæmia and pigmentation. Beginning with the duodenum, there is found generally an abundance of bile and more or less injection and pigmentation of the villi appearing in the form of closely set points and fine lines. The remainder of the small intestine may show with the stomach more or less marked congestion, or there may be patches marked by the injection of minute vessels. In many of the cases examined the mucosa was pale and concealed by a thin layer of a grayish pasty consistency made up largely of desquamated epithelium. The walls of the lower half of the small intestine contained quite invariably small worm tubercles. These appeared from the serous surface as dark blueish, slightly elevated nodules. In passing the opened intestine between the fingers the mucosa was found intact, while the tubercles gave one the sensation of small shot in the walls. They harbor a parasitic worm and have nothing to do with the disease.

In the large intestine we find more or less hyperæmia and pigmentation in longitudinal lines corresponding to the summits of the folds of the mucous membrane. This condition is more marked in the cæcum and rectum than in the colon, and seems to be associated with the constipated condition. Thus, the cæcum is in some cases distended with very hard, dry, fecal balls, and some may be found in the rectum. In some cases no abnormal condition of the large bowel is discoverable.

Differences in the pathological changes of our cases and those studied by former observers.—We have already called attention to the fact that, while jaundice was rare in our cases, it has been rather common according to other investigators. In fact it has been named "the yellow fever of cattle" on the strength of this symptom. Attention has also been called to the lesions of the fourth stomach in this respect. The causes for these differences may perhaps be looked for in the different condition of the animals examined. The Metropolitan Board in 1868 examined cattle which had been traveling and had undergone much hardship both by rail and on foot. They were all western animals, which succumbed soon after their arrival in New York. How far the deprivation of food and water, the crowding, the constant motion, and the marching may have contributed to a more active circulation and to an absorption of the obstructed bile from the liver into the blood must remain a conjecture. In our cases the animals were simply pastured and the frequent blood examinations as well as the taking of the temperature were carried out with the least possible disturbance to the animals. Again the animals used by us weighed between 500 and 800 pounds. They were not more than average animals in an average condition of flesh. It may be that the large fat animals in a plethoric condition would develop the peculiar condition of the muscular system, the jaundice and the more marked hyperæmia (and sloughing?) of the fourth stomach and intestines observed in 1868. The essential lesions, however, are precisely the same. The disease first studied by Gamgee and the Metropolitan Board of Health in 1868 is the same as that now occupying our attention. The changes going on in the blood, the liver, spleen, and kidneys are so striking and peculiar that they could not very well belong to two different maladies.

CHANGES IN THE CORPUSCULAR ELEMENTS OF THE BLOOD.

The condition of the blood, so far as determinable by the naked eye, has already been referred to. It grows very thin and watery as the disease progresses. This fact was emphasized by the earliest students of this disease, the investigators of the Metropolitan Board in 1868. Its prime significance seems to have escaped them and subsequent ones. In the preliminary pathological examination of four cases in 1888 the destruction of red corpuscles explained, best of all, the conditions observed. Hence the importance of concentrating the attention on the blood and its cellular elements was at once recognized. In 1889 arrangements were made by which cases of the disease could be studied during life at the experiment station, and within easy reach of the laboratory, in the District of Columbia. In order to measure in some accurate manner the changes going on in the blood, the red corpuscles were counted as soon as living cases were accessible. The result proved surprising in the extreme. It was found that there is a destruction of red corpuscles going on from day to day quite enormous in acute cases. Going parallel with this diminution in the number of corpuscles a change in their size and appearance became manifest which demanded a careful study in order that a distinction between the stages of the intraglobular parasite and the altered corpuscles which might be confounded with them could be made. As the investigations proceeded an accurate knowledge of these changes proved very valuable as a means of diagnosis. In a number of cases the recent existence of Texas fever could be at once determined by their presence, even though the Texas fever parasite was no longer to be detected in the blood. These changes must now be considered as next in importance to the parasite itself in the diagnosis of Texas fever in all its forms. The present chapter is therefore a consideration of the changes, both quantitative and qualitative, affecting the red corpuscles without reference to the micro-parasite accompanying them. This will be described in another chapter.

THE DESTRUCTION OF RED BLOOD CORPUSCLES.

The red corpuscles were counted with the apparatus of Thoma, constructed by Zeiss. In the direction for use accompanying the apparatus it is suggested that 200 spaces should be counted in order to reduce the errors to a minimum. Owing to the large quantity of work that had to be done in connection with the various field experiments to be described, the counting could not be carried to the point of accuracy indicated. Moreover, the quantitative changes in this disease are so gross that a slight error will not affect the comparative results. The method adopted was to count 40 spaces. Two parallel rows of squares through the ruled field were counted. Such rows were chosen through which an additional line was drawn in order to guide easily the eyes. Hence these rows were always four squares apart. By counting the red corpuscles in a row of squares any differences in their distribution from one side of the cell to the other were thus averaged. A comparison of the results of counts in the case of healthy controls, or of animals before the onset of the disease, shows a remarkable uniformity of results. Moreover, successive counts either from the same dilution or from separate dilutions of blood from the same animal collected at the same time, showed that the greatest margin of error was one to two hundred thousand, a comparatively insignificant figure in the work before us.

It was necessary also to make a modification in the collection of blood. The uneasiness of many animals, the presence of flies, the heat and wind on the fields made it necessary to act with great rapidity. Hence the complete filling of the capillary tube was dispensed with. Only a fraction of the length was filled with blood, usually from 0.6 to 0.9. The quantity aspirated was at once noted and the 3 per cent salt solution or Toison's fluid was drawn up to the mark indicated. In those cases in which the blood was very thin and the various squares contained only from 0 to 3 corpuscles about 80 squares were counted.

If, in the collection of the blood, the dilution with the salt solution or Toison's fluid, its proper mixing with the blood, and especially the placing of the drop in the cell, be properly carried out, the necessity for counting a large number of squares is made nugatory. Special care should be devoted to the cleaning of the glass cell and cover and the keeping away of all dust. When the coverslip has once been laid on the cell it should not be slid or moved about, so that the uniformity of distribution is not disturbed. The process of collecting the blood for counting is as follows:

In most cases the animals could not be removed from the field, and the examination of the blood had to be proceeded with on the field itself. The various appliances necessary for the securing of fresh and dried preparations of blood and the counting of the blood corpuscles were carried in boxes or trays. The animal was secured by its head, and, in rare cases, one hind foot was tied to forestall any injury to the one collecting the blood, whose entire attention had to be given to this work. If desired, a rectangular box or stall may be placed in each field into which the animal may be led and secured. Or such a box may be placed under cover and then rainy weather will not interfere with the work.*

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*Such a box is best constructed as follows: Place three pieces of 2 by 4 studding, 4½ feet long, on the floor parellel to each other and 3 feet apart. Erect uprights also of 2 by 4 studding and 3 feet high, 15 inches from the ends of each horizontal piece, and brace securely from the outside. Within this framework build, by boarding up on the inside, a rectangular box 6 feet long, 3 feet high, and 2 feet wide, open at the top and one end. The front closed end of the box is hollowed out to a depth of 7 to 8 inches to receive the neck of the animal in the standing position, so that the head may extend over the end and be secured to a framework extending 1½ feet beyond the box and attached to the box 2 feet from the floor.

The whole framework must be very securely put together. The projection of the studding at the base with the braces on the outside serves to strengthen the box and to prevent its upsetting by the struggling of the animal. A bar can be slipped in behind the animal to keep it from backing out, and a rope or strap over the withers fastened to the sides of the box will prevent it from rearing forward.

In collecting the blood the hair is clipped and shaved away over an area 2 or 3 inches square on that region of the rump overlying the flaring hip bones (ilium), where the animal is most accessible for this work. The shaven skin is washed and rinsed with clear water and dried with absorbent cotton. To make the incision a spring lancet is used, resembling those advertised and figured in most catalogues of medical and veterinary instrument makers. The incision must pass through the depth of the skin in order that a sufficient flow of blood be secured. The depth to which the blade of the lancet penetrates may be regulated by a screw in the forked guard attached to the lancet. The lancet should be flamed in passing from one animal to another. The soap and razor should not be used on sick and healthy alike, for, although we have no positive evidence that the disease may be transmitted, either by these things or even by the lancet, such transmission is within the range of possibility.*

The number of red corpuscles in cattle (obtained from the counties around the District of Columbia) during health fluctuates more or less, as might be expected, but may be put down as six millions in a cubic millimeter. Seven millions in winter, and five millions in late summer and early autumn seems to be not uncommon. The number may be said to fluctuate, however, between four and one-half and eight millions, since these extremes are occasionally met with. The following counts from healthy animals will serve as illustrations:

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* We give a specimen page of the figures obtained from counting the blood corpuscles as described above:

No. 218 (healthy control.)—August 6, 1892, 10 a. m.: Temperature, 101.8; respiration, 64; pulse, 56; blood collected, 7.3 divisions.

(Toison's fluid was used in this estimation. It consists of distilled water 160 cc., neutral glycerin 30 cc. (at 30°), sodium sulphate 8 grams, sodium chloride 1 gram, methyl violet .025 gram. It stains the white corpuscles so that both red and white may be counted in the same preparation.)

First row of squares:

$$\begin{array}{rrrr} 8 & 12 & 9 & 13 \\ 13 & 11 & 10 & 14 \\ 12 & 13 & 13 & 10 \\ 14 & 19 & 8 & 13 \\ 12 & 7 & 10 & 10 \\ \hline \end{array} \qquad \frac{463\times100\times4000\times10}{40\times7.3}=6{,}342{,}465 \text{ red corpuscles.}$$

$$61+62+50+60=233$$

Second row:

$$\begin{array}{rrrr} 8 & 14 & 7 & 13 \\ 11 & 9 & 10 & 8 \\ 15 & 13 & 13 & 13 \\ 8 & 8 & 15 & 17 \\ 12 & 13 & 9 & 14 \\ \hline \end{array}$$

$$54+57+54+65=230$$

$$\underline{}$$

$$463$$

Seven white corpuscles in 400 squares.

$$\frac{7\times100\times4000\times10}{400\times7.3}=9{,}589 \text{ white corpuscles.}$$

In counting 40 squares the various factors in the fraction above balance each other in such a manner that it is only necessary to divide the number of corpuscles (463) by the quantity of blood collected (7.3 divisions of melangeur instead of 10, the quantity usually collected). The first figure of the quotient gives millions. A similar simplification of the formula for the white corpuscles may be used.

No. 109.

September 18, 1890	5, 726, 000
October 3, 1890	6, 190, 000
October 14, 1890	5, 807, 000

No. 91.

October 1, 1890	4, 672, 000	Placed in infected field.
October 7, 1890	4, 833, 000	
October 30, 1890	4, 670, 000	

No. 143 (control animal).

September 29, 1890	6, 261, 900
October 8, 1890	6, 835, 000
October 25, 1890	6, 500, 000

In addition to these illustrations there was found a large number of figures relating to the number of red blood corpuscles of cattle in infected fields, but not yet diseased. The examination of the blood in 1891 was extended to many, and in 1892 to all, animals at the beginning of experiments, in order to get at the approximate normal for each animal, and also to make sure that the animals were in good health. Among the many cases which came under observation only one anæmic cow was found; that is, only one whose red corpuscles fell below four and a half millions. This animal (No. 136) was affected with some catarrhal discharges from the vagina. Her record was:

September 30, 1890	3, 911, 300
October 8, 1890	3, 753, 800
October 18, 1890	3, 735, 300

In one case tuberculosis, limited chiefly to the lymphatics, was discovered at the autopsy. Even in this animal, after three days of high temperature from Texas fever, the corpuscles still numbered 5,125,000. There could have been no anæmia, therefore, in spite of the tuberculosis.

The destruction of red corpuscles is the essential phenomenon of Texas fever, from which all the various pathological processes take their origin. Some illustrations will demonstrate these statements.

No. 80.

[July 5, 1890.—Beginning of exposure in infected field (Texas cattle).]

Date.	Number of corpuscles.	Remarks.
July 31	6, 290, 000	
August 4	5, 052, 000	
August 7	5, 631, 000	
August 23	5, 422, 000	
August 24	5, 434, 000	First high morning temperature on Aug. 24.
August 28—1 p. m.	2, 025, 000	To all appearances in dying condition; killed.

No. 120.

[July 5, 1890.—Beginning of exposure in infected field (Texas cattle).]

August 11	6, 123, 000	
August 13	7, 171, 000	
August 16	5, 370, 000	
August 27	3, 210, 000	First high morning temperature Aug. 24.
August 29	1, 675, 000	Died at 8 p. m.

No. 163.

[July 2, 1891.—Beginning of exposure in infected field (North Carolina cattle).]

August 13	5, 000; 000	
August 24	3, 388, 800	Temperature last taken on 21st, then normal.
August 25	2, 645, 000	Killed.

These few examples will suffice to illustrate the rapid disappearance of red corpuscles from the circulating blood. They are by no means extreme cases, but stand for the average rate of disappearance in acute cases. This would be for No. 80 at the rate of about 1,000,000 corpuscles per cubic millimeter a day during the last three days; for No. 129 at the rate of 800,000, and for No. 163, 700,000. That this rate of destruction is very high becomes evident when we bear in mind that in No. 80 it represents the loss in twenty-four hours of one-sixth of all the red corpuscles usually circulating in the body. In the other cases it represents from one-seventh to one-eighth of the whole number.

In the mild nonfatal type the rate of destruction is lower.

No. 56.

[September 8, 1890.—Beginning of exposure in infected field (North Carolina cattle).]

Date.	Number of corpuscles.	Remarks.
1890.		
September 20	6,844,000	
September 22	5,640,000	
September 29	5,307,000	
October 9	5,436,000	
October 22	4,666,000	
October 25	2,754,000	
October 30	2,720,000	
November 6	2,344,000	
November 8	1,984,000	
November 13	1,183,000	Lowest point reached.

In this animal, the loss which in an acute case would have taken place in four or five days occupied from seven to eight weeks. In these cases, however, other elements enter, such as the constant active production of new corpuscles which masks to a great degree the actual rate of disappearance. Moreover, the destruction seems to go on not regularly, but in jumps or paroxysms. Thus in the case before us there was a decrease of 1,912,000 from October 22 to October 25, but practically a standstill from October 25 to October 30, and so on.

Another fact of considerable interest brought out by the periodic estimates of the red corpuscles is the oscillation of the number up and down during the disease in some cases. It seems as if a period of destruction were followed by a period of regeneration, and this again by a period of destruction. This oscillation is occasionally traceable to the reappearance of the microparasite in the blood, as in one case, in which three different downward movements in the number of red corpuscles are associated with the reappearance of infected corpuscles. In other cases the microscope did not, during the downward movement, demonstrate the presence of the parasite, probably because such observations were often of one or two weeks apart. The supposition at the time was that such cases were getting well, and the tardy examination of the blood showed instead of the expected return to the normal another downward movement. A very good illustration of this oscillation is afforded by the following case, the result of the intravenous injection of blood from a sick native:

September 16, 1890	6,890,000
September 22, 1890	5,430,000
September 24, 1890	4,562,000
September 29, 1890	5,274,500
October 4, 1890	3,902,000
October 8, 1890	*5,983,600
October 22, 1890	4,333,000
November 4, 1890	5,586,000

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*This number is evidently too high as compared with the preceding, and must be explained by assuming other forces at work in concentrating the blood beside the mere regeneration.

It has been assumed above that the disappearance of the red corpuscles is chiefly due to their destruction. We have already seen that in the cases under observation there were very few hemorrhagic lesions which might for the time being reduce the number. The ticks can not be regarded at all as abstractors of blood in this stage.* That they are largely destroyed within the body is shown (1) by the loss of hæmoglobin through the kidneys, (2) by the overproduction of bile which is abnormal in the abundance of pigment flakes, and (3) by the actual observation of this destruction by the microparasite under the microscope.

THE REGENERATION OF RED BLOOD CORPUSCLES.

As determined by actual enumeration.—Passing by, for the present, any further discussion of this interesting subject, let us turn to the regeneration of the red corpuscles. This, of course, varies in accordance with the vigor of the animal, its food, and the season of the year. It is, even under adverse circumstances, remarkably rapid and well adapted to occasion surprise.

The regeneration of corpuscles as indicated by the microscope is not in all cases indicated by the counting apparatus. That is to say, the regeneration may begin before the destruction has ceased, and if the latter process is the more active the count will show a loss, although the microscope may demonstrate the presence of a large number of new corpuscles. This actual regeneration, as indicated by abnormal forms, will be discussed farther on; here we will simply refer to the increase of the corpuscles as indicated by actual counting. A few illustrations will serve our purpose:

No. 64.	
September 9, 1890	3,154,000
September 16, 1890	4,575,000
September 29, 1890	4,869,000

No. 102.	
September 18, 1890	1,950,000
October 4, 1890	2,682,700
October 17, 1890	3,894,700
November 6, 1890	5,120,000

No. 65.	
November 4, 1889	1,720,000
December 2, 1889	3,463,000

No. 56 (Mild type).	
November 13, 1890	1,183,000
November 15, 1890	1,534,000
November 17, 1890	1,655,000
November 21, 1890	2,615,000
November 26, 1890	3,880,000
December 2, 1890	4,706,000
December 11, 1890	4,603,400

The activity of the regeneration is well brought out in No. 56, a large, vigorous ox. From November 17 to November 26 the red corpuscles appeared in the circulation at the rate of 250,000 per cubic millimeter per day. From November 26 to December 2 the rate of increase was about 140,000 a day. It is furthermore remarkable that in the case of a few calves under observation the corpuscles rose rapidly in number, although the animals did not thrive after the fever departed. This was likewise observed in some adults. The blood-forming function seems to go on independently of downward processes of other functions.

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*The enlarged spleen, it is true, absorbs from 1½ to 3 pounds of red corpuscles, roughly speaking, since its enlargement is mainly due to an engorgement with them. If we regard the red corpuscles as constituting one-third of the weight of the blood, this quantity would correspond to 4½ to 9 pounds of blood. If we take the blood in cattle as one-thirteenth of the body weight (v. Limbeck, Klinische Pathologie des Blutes. S. 49) an animal weighing 800 pounds would carry 61.5 pounds of blood. The spleen would thus absorb the corpuscles of one-fifteenth to one-seventh of the entire blood and reduce the number of corpuscles in a cmm. one-third to one million. The capillary engorgement of the kidney, heart muscle, and perhaps other organs may account for some losses, but this is mainly due to infected corpuscles which may be regarded as destroyed. The above calculation is, of course, very approximate.

No. 82.

October 11, 1890	3,542,800
November 13, 1890	4,240,000
December 2, 1890	5,643,000

In this calf, the number of corpuscles steadily rose after the disease had passed away, in spite of growing weakness and diarrhea. On December 4 it was unable to get on its feet, so that it had to be killed December 6. Opposed to these cases in which the blood-forming function asserts itself under difficulties, there are others in which the strain upon this function has been so severe that several phenomena appear.

The corpuscles may increase in number but not reach the full tide of the number present before disease until the following season. Or there may be a temporary standstill in the production of corpuscles when the number is still very low. In none of the cases in which the convalescence was followed with the corpuscle counter did the number remain below four millions after the end of three or four months.

As determined by microscopical examination.—The reproduction of new corpuscles as witnessed by microscopical examination presents a number of important phenomena. Taking it for granted for the present that we are able to detect newly formed corpuscles by certain peculiarities of form and staining which they possess during the more advanced stages of anæmia, we may lay down a few general propositions concerning this production. In the acute type of Texas fever, when the daily loss of corpuscles amounts to from one-sixth to one-eighth of the normal number, there is observed little or no production of new corpuscles, until the number has fallen to one million or two millions, and the normal temperature has returned. Then an abundant crop of new forms is seen, even when the animal succumbs in the end. In the mild, non-fatal type, in which the destruction of red corpuscles goes on much more slowly, and in intervals, and in which there is but little fever and general disturbance of health, the production of new corpuscles begins at once and continues parallel with the destruction of older ones throughout the course of the disease. It is in such slowly progressive cases that the changes in the corpuscles accompanying their regeneration is best studied. Before proceeding to a description of these forms, so valuable in the diagnosis of Texas fever, a brief description of the methods employed is called for, since they are the same as those used in the important study of the microörganism or blood parasite of this disease.

The blood was examined in the fresh and in the dried condition. The drop of blood as it oozed from the incision was received at once on a flamed platinum loop soldered into a glass rod like the ordinary bacteriological loops used for inoculating, etc. The platinum loop is simply brought in contact with the blood, and the drop placed on a clean glass slide and immediately covered with a cover glass and sealed with paraffin if the preparation is to be kept under observation for some time. The sealing is best done with a camel's hair brush dipped into melted paraffin. It is always desirable to have only a single layer of corpuscles in the preparation. To insure this there should be no speck of dust on slide or cover, and the quantity of blood taken must be small. This can be regulated by adjusting the size of the platinum loop. In the usual method of touching the drop of blood with the cover directly the quantity of blood cannot be limited, and many preparations are subsequently found to contain too many corpuscles.

The preparation of dried blood requires much care. Without going into an extended discussion of the relative merits of different methods we give the one found most satisfactory and adopted in these investigations. It is most readily understood by referring to Fig. 2.

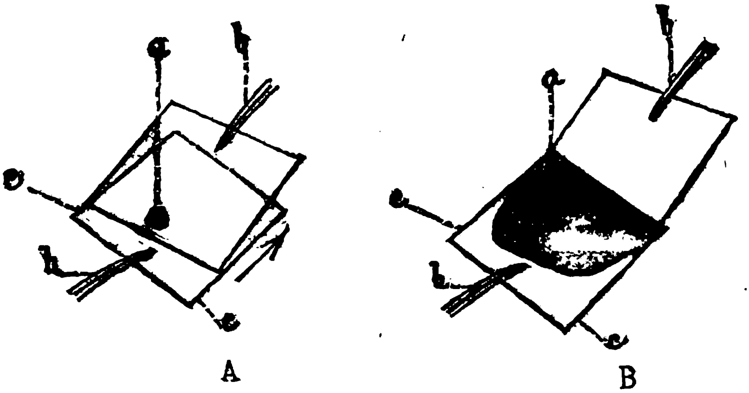

FIG. 2.—Method of preparing dry blood films on cover glasses.

In A, a cover glass *cc* is held by a pair of forceps *b*, and has on its upper surface a drop of blood *a* placed there by a platinum loop. A second cover glass or "scraper" held by forceps is resting on the first with one edge, and is held at an angle of 15° to 20° to it. As shown in B the upper cover is drawn over the lower, and as its edge sweeps over it it spreads out the drop of blood in a thin layer. In rapid work the forceps may be dispensed with. The lower cover is held between thumb and forefinger of the left hand at *cc*, and steadied below with the tip of the middle finger, and the upper is firmly seized between thumb and forefinger of the right, where the blades of the forceps would rest. By using a pair of forceps, which may be adjusted by a clamp, the scraper may be fastened between the blades, and by rotating it its edges may serve to spread out three or four separate preparations. The scraper should be thick and its edges smooth in order to insure uniform distribution of the blood. It is needless to say that this simple process is much superior to the barbarous one of placing two cover glasses together face to face in order to allow the blood to spread in a film between them, and then drawing them apart. Each corpuscle is thereby subjected to a long crushing process, whereas in the method before us this is entirely avoided. The thinness of the blood film depends upon several things, such as the condition of the cover as regards freedom from all grease, the size of the drop of blood, the regularity of the edge of the second cover or "scraper," and the angle at which it is held during the operation. The layer is not of even thickness over the entire cover glass, but is thinnest where the scraper has begun its work, and densest where it has left off at the edge of the cover, as shown in the figure. This is no disadvantage, however, but rather an advantage, as it furnishes us with a layer of varying thickness which is of service, as will be pointed out farther on. The place where the scraper began, and where the layer is composed of isolated corpuscles or groups of contiguous ones, have dried so rapidly that they are in a state of perfect preservation. Every preparation has thus some spots where the corpuscles are thoroughly "fixed," even if, as a whole, it may have been a failure.

The essential condition of success in dry preparations of blood is to get the corpuscles into a dried state as soon as possible after the blood is shed. For this reason it might seem desirable to eliminate the use of the loop and touch the exuding blood directly with the cover glass, as is frequently done in the study of human blood when the finger tip is pricked. But the circumstances are different in cattle. The prick is useless and an incision must be made. The surface of the skin is flat and a cover glass touched to the oozing blood may bring with it epithelial scales and other objectionable things from the skin accidentally touched, however much the latter may have been cleansed beforehand. Still, in rapid work, it is now and then of advantage to touch the oozing blood directly with the edge of the scraper. Not infrequently the quantity of blood is small and does not well out of the incision. A loop then becomes indispensable in lifting it out.*

The dried films of blood, kept labeled in small pill boxes until used, are exposed in a dry-air oven to a temperature of 110°–120° C. for one and one-half to two hours. Drawing the covers through the Bunsen flame as for bacteriological preparations is liable to fail at any time from overheating or underheating, and is not to be recommended. When, for rapid work, this method must be used the cover glass should be drawn through the flame four times, each movement to occupy a second. Three movements are usually insufficient, for when the stain is applied the coloring matter of the corpuscles is dissolved out and the preparation is spoilt. When overheated the red corpuscles are apt to stain so deeply that any granules or parasites within them are hidden from view.†

The staining process used for the dried and heated cover-glass preparations is very simple. The cover glass is either allowed to float on a filtered solution of Löffler's alkaline methylene blue or else the staining fluid is dropped upon the cover glass and allowed to remain from one and one-half to two minutes. It is thereupon washed in distilled water and dipped into a one-third per cent solution of acetic acid for an instant to remove any diffuse stain in the red corpuscles. Lastly the acid is washed away in distilled water.‡ It is then ready for examination in water or for drying and mounting in xylol balsam. Care must be taken to make the action of the acetic acid solution momentary, otherwise the decolorization may go too far.

If we examine the blood of a mild autumnal type of fever every one, two, or three days, as described, certain phenomena appear regularly at certain stages of the anæmia. When the number of corpuscles has fallen to 3,000,000 a variable number of enlarged corpuscles appear. While the normal ones measure about 5 or 6 μ in diameter, the enlarged forms will be from 6 to 8 μ in diameter. This is the first change observable, and it appears only when, as stated, the number has fallen to one-half the normal. As the destruction goes on and the number sinks lower, the large cells become more numerous, but they at the same time grow thinner and more delicate. When the number is below two millions hæmatoblasts or nucleated red corpuscles begin to appear, and their number may be as high as 5 per cent of all corpuscles still in the circulation. It may also be noted at this stage that some of the large corpuscles show one or more small vacuoles in a cluster in the center of the corpuscle. These contain sometimes a barely visible (× 1000) particle in rapid dancing motion. These phenomena are all the result of the anæmia, as will be shown later, and have nothing to do with the microparasite. The variation in size of the red corpuscles is illustrated in Plate IV. Fig. 3, Plate V, Fig. 3, and on Plate IX.

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*More recent observations during the fall of 1892 have shown quite conclusively that cold rapidly destroys the form of red corpuscles. In fact it was impossible to prepare films out of doors in a temperature below 50° F.

†In place of a hot-air oven kept at the proper temperature by a thermo-regulator, the device of Ehrlich may be used. This consists of a Bunsen burner or a small kerosene stove and a strip of sheet copper laid over it. It is evident that at different distances from the source of heat the copper will be of different temperatures. By placing drops of water on it the place where the temperature is 100° C. can be approximately ascertained by the behavior of the water. The cover glasses are laid upon the sheet of copper for a certain length of time at a point corresponding roughly to 120° C.

‡If the film has been properly heated (not overheated), decolorizing is quite unnecessary.

When preparations of blood are dried and stained, another set of changes are observed which were hidden in the fresh preparations. These changes are limited to the enlarged corpuscles. When the number falls below 3,000,000, a few corpuscles are now seen among large numbers of others, whose disk is sprinkled over with a variable number of granules which stain deeply in the alkaline methylene blue.* These granules vary in size. In some preparations of blood at this stage, they may be as large as 0.5 μ in diameter, and there may be from 15 to 30 in a corpuscle. A prolonged observation of these granules has suggested the theory that their size depends largely on the rapidity with which the film of blood has been dried. In those portions of the layer which are thinnest and fixed instantly, only small granules are seen; that is, such as are, perhaps, not more than 0.1 μ in diameter. But in those portions of the layer in which the corpuscles are massed two or three deep, the large granules are found, if present at all. The immediate inference is that the stainable matter diffused through the corpuscle collects into larger nuclei if there is any time elapsing between the shedding and the drying of the blood. This time is longest in the dense portions of the film. (See Plate IV, Fig. 3, Plate V, Fig. 3, and Plate IX.) The granules in a cell are not all of the same size, although there is not much variation in this respect in the same corpuscle. There are cells with very fine granules, and cells with very coarse granules. Cells with granules of intermediate size are also found. The large granules are usually round, and resemble very closely micrococci, but the slight irregularity in form and size disposes one to reject at once the view that they may be micrococci. The large granules closely resemble one of the stages of the microparasite of Texas fever, as will be pointed out later on. The small granules do not appear round, but more angular, and even slightly rod-shaped. They are distributed quite uniformly over the disk, excepting in a few cases in which there was a central space free from them. These bodies stain, as nuclei and bacteria do, with basic aniline dyes, and they are not readily decolorized with acids. They are stained by hæmatoxylin and refuse to stain with Ehrlich's acid or neutrophile dyes.

The granular forms are characteristic of that stage of the anæmia in which the number of corpuscles stands between two and three millions. When it falls below 2,000,000 other peculiar forms appear. The enlarged corpuscles grow thinner and larger, more easily distorted when the drying is retarded, and, when stained as above indicated, many of them show a diffuse, rather pale bluish coloration not easily removable by acetic acid. (Plate V, Fig. 1; Plate IX.) Some show instead of this diffuse coloration an aggregation of exceedingly minute granules which might easily give the impression of a diffuse stain. These types are not infrequently accompanied by hæmatoblasts. It must not be understood that the different stages of the anæmia are characterized by the exclusive presence of one or the other of these changed forms. The granular or "punctate" cells may be met with in the various stages of the anæmia. Likewise the diffusely stained forms are in a few cases encountered with the punctate forms before the anæmia has become advanced. But as a rule we meet first with the simply enlarged corpuscles, next with the "punctate" forms, and lastly with the diffusely stained or "tinted" forms and the hæmatoblasts.

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*It should be borne in mind that under the conditions formulated above the normal red corpuscle does not retain the stain, either in the form of granules or diffusely.

It is not desirable to go into any details concerning the nature of these corpuscles, as this has already been done from the standpoint of general pathology in another publication where the literature is also taken into consideration.* A few remarks are, however, in order as bearing upon an understanding of the disease before us. The various modified forms of red corpuscles, which we have been considering, are perhaps all embryonic or immature forms. They have been hastened into the circulation from their place of manufacture, the red marrow of the bones, to supply an urgent demand created by the destruction of vast numbers of red corpuscles by the Texas fever parasite. This demand grows more and more pressing as the number of corpuscles continues to go down, and consequently more and more immature forms are sent until the hæmatoblasts themselves, the progenitors of the red corpuscles, appear. The reasons for considering them embryonic or immature red corpuscles can not be entered into here. It must suffice to state that a comparative study of the embryonic cells in the red marrow and of these modified corpuscles in the circulation shows them to be the same.

The stainable material in these new corpuscles may be some form of protoplasm imperfectly converted into the discoplasm of the adult red corpuscle. We have already presented the theory that the granules may be derived from the diffusely stained material by a condensation in the shed blood. This, of course, will demand special study. It is enticing to interpret, as has been done, the larger granules as fragments of the nucleus of the hæmatoblasts, but there are no observations directly supporting this view.†

The same modified or embryonic forms of corpuscles appear in the acute type of Texas fever after the high temperature has disappeared and the stage of convalescence has begun. They disappear speedily from the circulation when the number of corpuscles again begins to rise. In fact they seem to disappear when the number has risen to 2.5 millions. Even when the regeneration does not go on quickly and the anæmia remains stationary for a time the punctate and tinted cells speedily disappear, while the simply enlarged corpuscles or macrocytes remain in the circulation, or rather are produced as such, until the number is above three millions, and they do not regularly disappear until the number is over four millions.

While there could be no reasonable doubt that the forms described as abnormal are immature red corpuscles, there was enough resemblance between the larger granules and the smaller stages of the parasite to make a crucial experiment necessary. It might likewise be claimed that the body to be presently described as the microörganism of Texas fever is nothing more than a phenomenon of embryonic or perhaps degenerated red corpuscles caused by some still unknown agency, which itself is the direct cause of the disease. It became therefore necessary to show that the parasites are not the result of the disease, and that in artificial anæmia they do not appear. To prove this, bleeding was resorted to—first upon a sheep, then upon a cow. The artificial anæmia brought about caused the various modifications described above to appear in the blood of both sheep and cow, but the various forms of the parasite did not show themselves at any time. These experiments are of sufficient importance to warrant their publication here.

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* Theobald Smith: On changes in the red blood corpuscles in the pernicious anæmia of Texas cattle fever. Trans. Assoc. Amer. Physicians for 1891.

† It is a curious fact that the granular, or "punctate" cells, have not been seen in the parenchyma of the various organs (spleen, liver, kidneys), although the diffusely stained or "tinted" cells are present.

Male lamb, 5 months old, still nursing—gross weight, 65 pounds.

Date.	Number of red corpuscles in a cmm.*	Quantity of blood withdrawn from jugulars.	Remarks.
1890.		*Grams.*	
June 17	11,500,000	336	
June 18	10,500,000	....	Blood corpuscles not visibly altered.
June 19	9,200,000	406	Do.
June 20	6,500,000	....	Do.
June 23	8,000,000	330	Many corpuscles enlarged (macrocytes). A few punctate cells.
June 25	7,500,000	....	20–30 per cent corpuscles enlarged, about 10 per cent punctate.
June 27	8,200,000	160	The same number of macrocytes as before. Punctate cells have nearly disappeared.
July 1	7,500,000	546	Macrocytes as before. No punctate cells.
July 3	6,500,000	441	Do.
July 5	3,600,000	650	30–40 per cent macrocytes. 5–10 per cent punctate and tinted cells.†
July 7	5,000,000	....	20–30 per cent punctate and tinted cells, the latter relatively increased.
July 10	7,100,000	....	Macrocytes diminishing. Punctate and tinted cells absent.
July 15	8,900,000	....	Corpuscles normal.
July 25	8,900,000	....	Do.

* This number was obtained before the bleeding in every case.
† See Plate IX, Figs. 1 and 2.

Cow No. 168.

Date.	Number of red corpuscles in a cmm.*	Quantity of blood withdrawn from jugular.	Remarks.
1891.		*Grams.*	
Aug. 3	6,762,500	2,268	Blood elements not visibly changed.
Aug. 4	4,988,700	2,325	Do.
Aug. 5	4,652,700	....	Do.
Aug. 6	5,227,800	3,827	Do.
Aug. 7	3,820,000	4,251	Do.
Aug. 8	3,004,600	4,989	10 per cent macrocytes, 2–3 per cent punctate corpuscles.
Aug. 10	2,253,700	....	20 per cent macrocytes, 15 per cent punctate corpuscles.
Aug. 11	2,143,000	....	Same as yesterday.
Aug. 12	2,114,750	....	Same as yesterday (Plate IX, Figs. 3, 4).
Aug. 14	2,538,400	....	Numerous macrocytes, 5 per cent punctate corpuscles.
Aug. 17	3,202,000	....	Macrocytes as before. A few punctate corpuscles.
Aug. 22	3,200,000	....	Macrocytes as before. No punctate corpuscles.
Aug. 29	4,325,000	....	Only a few macrocytes.
Sept. 8	4,784,000	....	Do.

* This number was obtained before the bleeding in every case.

These two experiments show that the various changes which the red blood corpuscles undergo in Texas fever are solely the result of the rapid and enormous loss of red corpuscles. The enlargement of the corpuscles, the presence of stainable matter in them in the form of large and small granules, uniformly diffused, are phenomena accompanying severe loss of blood by whatever means this may have been brought about, and are indicative of an active regeneration of the blood elements. We are therefore justified in drawing a sharp line between these phenomena and those to be subsequently described as the Texas-fever parasite.

The white corpuscles of the blood did not obtrude themselves, so far as fluctuation in numbers is concerned, during the various stages of the acute and mild types of the disease. Hence quantitative determinations were not attempted until the latter part of the season of 1891, when Toison's fluid was used. Both red and white corpuscles were then estimated with little extra labor in the same preparation of blood. In all cases the 400 squares of the ruled cell of the Zeiss apparatus were counted. The number of leucocytes in these spaces is, however, so small (from 3 to 15) that we might anticipate only an approximate accuracy, unless we take the average estimate of three or four preparations. For this no time could be taken. Hence the figures as given in the appendix, based upon the method here described, can not be regarded as of much value.* As far as they go, they indicate not very much fluctuation. Any unusual increase in numbers was not noted in the stained preparations of any case which came under observation. In some cases an abnormal crowding together of leucocytes was observed in dried preparations, which crowding must be regarded as having existed within the blood vessels, for there was no time for any massing together after the blood had left the vessels.

Whether the disease affects the different kinds of leucocytes either qualitatively or quantitatively has not entered into the scope of this investigation. It should be said, however, that in the stages of advanced anæmia, when hæmatoblasts are occasionally detected in the circulating blood, peculiar round bodies, which stain deeply and solidly with methylene blue, and which are a trifle smaller than red corpuscles, are frequently detected. A careful comparison of these with the nuclei of the hæmatoblasts makes it safe to regard the former as such nuclei which have been set free in the circulating blood.

THE CAUSATION OR ETIOLOGY OF TEXAS FEVER.

TEXAS FEVER IS NOT CAUSED BY BACTERIA.

We have thus far considered only the changes caused by the disease in the blood and the organs of infected cattle, and the manifestation of these changes during the life of the animal and after death. They are the concomitants and the resultants of certain causes at work in the body of the animal, and are to us interesting and important only in so far as they shed light upon the nature of these causes. And what are the causes at work in producing Texas fever? This problem has occupied the attention of a number of investigators since 1868. The general belief that Texas fever could be nothing else than an infectious disease due to the multiplication of some minute organism entering the body from without, led to a search for this microörganism by most of those who made this disease a special study. Dr. R. C. Stiles, of the Metropolitan Board, found in 1868 in the bile of Texas fever "preserved for analysis" minute vegetable organisms "in the form of spherical or irregular aggregations of micrococcus." From bile sent to Prof. Ernst Hallier, of Jena, Germany, this savant cultivated a mold (1, p. 1141–1150). It is needless to go into the details of this investigation, for its methods are exploded and its results fantastical to say the least. Gamgee examined the blood of Texas fever with high powers, but found nothing unusual. Drs. John S. Billings and E. Curtis, of the Army, studied the blood with reference to the presence of cryptogamic growths at about the same time, but their efforts were fruitless.

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*The inefficiency of the method used has been commented upon recently by other investigators who have had occassion to use it. A melangeur is now specially prepared by Zeiss for the estimation of the white corpuscles, and constructed to give a one-tenth dilution of a considerably larger quantity of blood, in order to concentrate the white corpuscles. This was latterly tried, but found useless, since the capillary tube is so wide that it no longer retains the column of fluid by capillarity and the blood drops away before it can be mixed with the diluting fluid. We trust that this defect may be speedily remedied.

Dr. D. E. Salmon, in 1883, described a diplococcus obtained from the spleen in cultures, but left its relation to the disease undecided (5, p. 13).

Dr. J. H. Detmers (5, p. 134) mentions the presence of bacilli and micrococci in the liver just after death, but none in the blood.

In a report published in 1888 Dr. Frank S. Billings claimed, somewhat pompously, to have discovered the "true germ" of Texas fever.*

This germ is said to be like the germ of Billings' swine plague (hog cholera). It "has been found in the blood, the gall, the urine, the liver, spleen, and kidneys" of every diseased animal that was examined. It produces Texas fever in cattle when inoculated in "unquestionably pure cultivations."

This seems to be sufficient proof. In scientific research, however, especially when an important discovery is involved, it is incumbent upon the investigator to give at least to some extent the details of his experiments, so that others may form an opinion of their own as to whether the work was properly done and the conclusions or inferences warranted. Instead of a conscientious report of work done we find in this bulletin of 138 pages the same padding used in the swine-plague report of the same author. Quotations, criticisms, and discussions, mostly foreign to the object of the report, together with an unwarranted dragging in of yellow fever, constitute the bulk of the text.

The germ of Texas fever as found by Billings stains at the ends. It grows on potato with a delicate straw color, which finally becomes a brick-red yellow. In the beef infusion gelatin tube it does not liquefy gelatin. These meager facts are not sufficient to distinguish this organism from a large group of bacteria living especially in the intestines of all domesticated animals. In fact, the few characters apply very well to the *bacillus coli communis*, a universal saprophyte in decomposing organic matter of intestinal origin, and one that has pathogenic properties with reference to smaller animals. This supposition is strengthened by the fact that Billings found in fresh and old manure bacteria not to be distinguished from the supposed Texas-fever germ.

As to the crucial test—the production of Texas fever by the inoculation of cattle with cultures of this germ—one case is reported. A black steer calf five months old presented four days after inoculation a temperature of 42.5° C. (106.5° F.). The temperature remained high for two days, when the animal was killed for examination. A glance at the autopsy notes shows that there is nothing to prove that the disease was Texas fever. In the liver "each acinus was most beautifully demarcated by delicate lines of a bright yellow color, which represented the interacinus and distended gall ducts." In Texas fever the bile injection is, as a rule, limited to the ultimate bile canaliculi within the acinus and rarely extends into the interlobular bile ducts. Was the bile stasis in the intralobular tissue actually seen under the microscope in this case? The important pathognomonic sign of Texas fever—hæmoglobinuria—was absent. The evidence that this steer was suffering from Texas fever is therefore not sufficient by any means, although we do not wish to claim that it was not Texas fever. This latter disease may have been induced by contact with ticks, or by the presence of the Texas-fever parasite in the cultures originally introduced with blood or bits of tissue. The total absence of any experimental details as to what culture was used, how it was injected, where the animals came from, etc., leaves us wholly in the dark as to the accuracy of the experiment.

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* The announcement of this supposed discovery is entitled to quotation:

"Hence the germ of the Southern cattle plague has been discovered, and I think that I may be pardoned the egotism of claiming this to be the first occasion in American medicine that not only one but two germ diseases of animal life have been traced out and their origin placed upon an impregnable basis.

"The order of events seems to be reversing itself! The sun of original research, in disease, seems to be rising in the West instead of the East, so far as America is concerned. This honor does not belong to me alone," etc. (8, p. 72).

These are all the facts of importance communicated by Billings in his report on the supposed bacterium of Texas fever.* Even if the evidence to be adduced farther on were not diametrically opposed to them, the meagerness and vagueness of the statements made by him would prevent any candid, unbiased observer from accepting them without great reservation. As to some other theories presented by Billings in his report, we shall recur to them farther on.

In May, 1890, a bulletin on Texas fever was published by Dr. Paul Paquin, of the Missouri Experiment Station (9), which describes investigations conducted between September, 1888, and March, 1890. Paquin claims to have found a germ, but it is impossible to discover from the descriptions anything concerning the nature of this germ, excepting perhaps that it does not exist, and that a variety of microscopic things were seen in the débris of the blood, bile, and liver which were considered by the author without any supporting proof as the Protean forms of a single organism. This kind of logic may suit disappointed observers, but it does not contribute anything to our knowledge of the subject. Moreover, in departing from established methods,† and in describing forms presumably existing which are wholly unlike any already recognized, the burden of proof rests upon the author and the work must be unusually well done to merit any attention. The conclusions reached by the author and presented on page 43 of the bulletin have none of them received even the shadow of a proof in the text. That bacteria may be found in cases of Texas fever is unquestioned, but that they have anything whatever to do in producing the disease demands rigorous proof. It would be difficult therefore to analyze a report of experiments, however conscientiously pursued, in which the fundamental elements of scientific research—a careful record of such experiments and their details and sound logic in drawing conclusions from such experiments are at fault. We refer here only to the work involved in the study of the cause of the disease. The vaccination theory will be discussed farther on.

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*After the above was written an article by Billings on the etiology of Southern cattle plague (Texas fever) appeared in the Journal of Comparative Medicine for 1892, beginning with the July number. The remarks in the July and August numbers may be passed over without comment. In the September and October numbers is contained practically what has been stated above, largely drawn from his report. There is quoted in addition an experiment with cultures from ticks with which he claims to have produced Texas fever. While we are pleased to see that, since reading preliminary articles in the reports of the Secretary of Agriculture, Billings is now paying some attention to ticks, we must wholly dissent from his conclusions, which are practically the same as those reviewed in the text. The conclusions which we have drawn and those presented by Billings in these articles may be safely left to the judgment of future workers in this field.

†See p. 8, which describes the method of preserving tissues.

In the third annual report of the Arkansas Experiment Station (1890), Dr. R. R. Dinwiddie reports that in a large number of cultures on different media from three cases of Texas fever no bacteria developed. He also isolated bacteria from the intestines which proved negative when inoculated.

In our own work the first problem which naturally presented itself was to determine whether bacteria could be regarded as the cause of the disease. Hence the very first and some of the later cases were utilized for this purpose. As to the first postulate necessary to be fulfilled in demonstrating the cause of any infectious disease—to find with the microscope the bacterium or other organism in the body of the diseased animal—this failed utterly in all the cases examined. The thousands of cover-glass preparations of the blood, spleen, liver, kidneys, etc., examined fresh and stained, never showed any bacteria excepting when the animal had been dead for a number of hours. Animals killed in a dying condition were almost invariably free from bacteria. Those which succumbed in the night in midsummer contained usually large bacilli which are denominated post-mortem bacilli in the appendix, and which are familiar to every worker in bacteriology. They are specially abundant in the carcasses of large animals, from the pig up, which have been dead some time; probably because a large carcass remains warmer and more thoroughly deoxidized than a small one, and thus becomes a good medium for this anaërobic bacillus to flourish in. These bacilli do not grow in ordinary culture tubes, excepting perhaps very feebly in the bottom of bouillon tubes and in impure cultures on agar-agar. They are somewhat broader than anthrax bacilli, have rounded extremities and usually occur single. They stain readily and deeply in all aniline dyes. The mention of this familiar intercurrent bacillus might have been passed over were it not that observers who have described bacteria in connection with Texas fever may have occasionally mistaken this as the cause (9, p. 43, third conclusion).

As to the cultivation of any bacteria from the blood and tissues in Texas fever, the results are equally negative. Special attention was paid to this phase of the problem in 1888. In the appendix will be found a brief statement of this work under the first six cases, and after the sixth a summary of the results obtained with a bacterium which appeared a number of times in the cultures. That it was the ordinary *bacillus coli communis* of the intestines which had found its way into the liver and thence into other organs there can be no doubt, for subsequent comparisons with *bacillus coli* from the intestines of healthy cattle proved them to be identical. It should also be remembered that this bacillus was present in exceedingly small numbers, as will be seen from the quantity of tissue or fluid used for inoculating the various culture media, and from the fact that they were never seen in cover-glass preparations. A large series of cultures were also made from several cases of the disease in 1889 and 1890 with equally negative results. In most cases the cultures remained absolutely sterile. In some a few cultures developed, the contents of which were explainable either as contaminations or as coming from an animal in which frequent skin incisions in the last stages of the disease may have led to the introduction of a few bacteria into the circulation. The results obtained from cattle infected by Texan animals were as negative as those from North Carolina cattle. Cultures have thus far been made from four different outbreaks, and the blood and the tissues have been examined microscopically from as many more.

We are, therefore, ready to admit that there are no bacteria in the blood and tissues of animals suffering with Texas fever, excepting occasional individuals which probably enter the circulation from the intestines by way of the disintegrated liver. But may there not be bacteria living only in the intestinal tract which send their toxic products into the circulation and thus cause disease? This hypothesis might be attractive to those who will insist on bacteria as the cause of Texas fever, but there are no facts to support it, and in view of the more definite results obtained by us its discussion is useless.

THE MICROÖRGANISM OF TEXAS FEVER.

(*Pyrosoma bigeminum, n. sp.**)

Although Texas fever is essentially a blood disease, and only secondarily affects the spleen, liver, and kidneys, most observers have failed to recognize this fact. R. C. Stiles (1) was the earliest and the only observer who laid any stress upon the changed condition of the blood corpuscles. He says: "The red blood corpuscles when examined immediately after removal from the body were shriveled and *crenated* without artificial provocation. * * * In one case many of the disks appeared to have lost a portion of their substance, as if a circular piece had been punched out, the addition of water failing to restore the disk to completeness." There can be little doubt that Stiles saw at that time the microörganism of Texas fever, without, of course, recognizing it, since this description applies very closely to the appearance of red corpuscles infected by this microparasite when the blood and the parenchyma of liver, spleen, and kidneys are examined fresh soon after death. Other observers have examined the blood, but have seen nothing unusual.

In 1888 during the examination of portions of the organs of a few cases, the destruction of the red corpuscles seemed to be the one prime phenomenon of the disease. The large quantity of hæmoglobin in the urine, and the peculiar condition of the liver and the bile indicative of hyper-secretion could not but lead to the hypothesis that there was some destructive agency at work in the blood. R. C. Stiles in 1868 assumed the liver to be the primary focus of the disease, and believed that the alteration of the blood elements was due to the absorption of bile from the liver into the circulation. This inference from the observed pathological phenomena is erroneous, for the liver is doing too much work rather than not enough, and the destruction of blood corpuscles goes on very early in the disease. The outcome of the work in 1888 was the formulation of several theories as to how the blood corpuscles came to their destruction:

(1) There may be organisms in the blood which by the production of toxic products act directly on the corpuscles.

(2) There may be some toxic substance in the digestive tract which

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*For the preliminary announcement of the discovery of this microörganism see the Annual Report of the Secretary of Agriculture for 1889, the Medical News for December 4, 1889, or the Proceedings of the American Public Health Association for 1889.

is absorbed into the blood and causes a dissolution of the red corpuscles. This substance may be the product of specific bacteria multiplying only in the digestive tract.

(3) There may be microparasites which invade the red corpuscles in a manner similar to those of malaria, and which by their growth disintegrate the containing corpuscle.

The first hypothesis was soon made improbable by the absence of any demonstrable organisms in the parenchyma of the various organs which are abundantly supplied with blood, such as the liver, spleen, and kidneys. To test the second the contents of the digestive tract, more particularly the small intestine, were carefully examined microscopically in 1888 and many plates and rolls of gelatin were made with the intestinal contents without bringing to light any other than the ordinary intestinal bacteria. It is true that this method was merely preliminary, and would have been followed by more exhaustive bacteriological studies of the digestive tract had not the third hypothesis furnished the clew. This, however, could not be tested in 1888, since no living animals were accessible, and the results of the study of the blood elements could not be considered reliable when obtained only from the organs of animals dead twenty-four hours, or even longer. In the very first case which succumbed on the experiment station at Washington, in 1889, certain microörganisms were found within the red corpuscles which will now claim our attention. It should be said, however, that these bodies were noticed in the spleen of a case as early as 1886.

PECULIAR BODIES FOUND IN THE RED CORPUSCLES OF HEALTHY CATTLE.

In endeavoring to prove the existence of specific parasites in the blood as causes of disease it becomes necessary to prove their absence during health. A large series of microscopic observations have been made upon the blood of cattle which were not infected, as well as upon those which were infected, before the disease had appeared and after it had passed away. In a preceding chapter we have treated of the number of red corpuscles in health and in Texas fever, also the changes which they undergo in this disease and the methods to be used in studying them. These methods apply in the study of the microörganism, and the reader is referred to them. The red corpuscles of cattle retain their form pretty well when examined in the fresh condition. After a time small conical protrusions form on them as they shrink and shrivel, and the stramonium forms begin to appear.

In 1890 certain minute bodies were first observed within red corpuscles of cattle in health. They are present in variable numbers. In some cases they are not found even after prolonged examination of cover-glass preparations (apochrom. 2 mm. oc. 4 or 8). In some a few may be seen in a single field. In several cases as many as 10 per cent of the corpuscles contained them. They may appear as barely visible points with a bright luster. Whether this brightness is a resultant of the color of the body itself and that of the corpuscle within which it is lodged it is impossible to find out. Suffice it to state that as we look into the microscope at a corpuscle containing one of these bodies it appears as a bright, almost golden speck. These bodies are not all of the same size and form, although their minuteness makes it impossible to express differences in figures. They range in size from mere specks to quite appreciable coccus-like bodies. Frequently a rod-like form with a central constriction, reminding one of diplo-bacteria, appears. It may be that the rod-like forms are observed as round bodies when standing on end within the corpuscle. In general they are rarely 0.5 μ large, usually much smaller. In the table of the appendix they are indicated provisionally as bright bodies. Plate VI, Fig. 9, gives an approximate idea of the relative size of these bodies. The third and the fourth corpuscle contain bodies which are much too thick, however.

Another interesting phenomenon of these bodies is their occasional motility. Many change their place within the corpuscle. When first detected the speck is usually situated at the periphery of the corpuscle. When watched closely for a few minutes it may be seen to move toward the center of the corpuscle, then back again toward the periphery. Then the movement may be along the periphery for a distance, succeeded perhaps by a movement across the entire corpuscle. The smallness of these bodies does not allow us to state whether this movement is passive and due to currents within the corpuscle, or whether it is the active, spontaneous movement of a living organism. There are, however, cases in which it is difficult not to accept the view that the movement belongs to a living body. The warm stage seems to accelerate these movements, but since heat is also likely to cause disturbance of the fluid within the corpuscle, this acceleration does not add to the proof that we have organisms before us. Fig. 10, on Plate VI, shows the path of one of these motile bodies. They do not reappear in dried and stained preparations, which means that they do not stain.

It has already been stated that these bright specks are present in the red corpuscles of healthy cattle. They are found in all seasons of the year and in most animals examined, in Southern (North Carolina and Texas) as well as native cattle. Besides these bright bodies, many of which are constantly changing their places within the corpuscle, there are occasionally seen in the fresh blood, both in health and during the fever period of this disease, bright rod-like bodies within corpuscles, which do not change their place. They lie usually at the edge of a paler area within the corpuscle, and the impression is conveyed that they are crystals derived from the hæmoglobin of the adjacent pale spot. There are from two to four of these minute rods in the affected corpuscles.

In addition to these intraglobular bodies present in healthy blood, certain forms are now and then seen in dried preparations stained in methylene blue which might be mistaken for Texas fever parasites. They are round, deeply stained coccus-like bodies situated quite near the periphery of the corpuscle and about one to two μ in diameter. There is never more than one in a cell. They differ from the intraglobular parasite by a deep blue stain and by the compact, round form. They are probably remnants of the nucleus of the ancestor of the corpuscle—the hæmatoblast.*

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* The interpretation of appearances in the field of the microscope is frequently beset with difficulties, and certain foreign bodies are likely to intrude and give rise to false impressions. To those accustomed to the examination of the blood elements this is not likely to happen, but to the beginner in this work certain suggestions will not be superfluous. In preparations of fresh blood from cattle a large number of very minute refracting spherical bodies about as large as the earlier stages of the Texas fever parasite are frequently found in all parts of the preparations. They may be attached to the disks of many corpuscles, and appear like intraglobular bodies. Their presence in other parts of the field free from corpuscles, as well as careful focusing, shows them to be foreign bodies. Prolonged observation has led to the inference that they are derived from the fat in the sebaceous follicles of the

THE MICROÖRGANISM IN THE ACUTE TYPE OF TEXAS FEVER.

In describing the microparasite of Texas fever we shall describe the various forms and stages as they are met with in actual examinations first, and then construct its life history as far as that is possible from the recorded facts.

In fresh blood of the acute disease during life.—When blood is drawn from the skin during the fever and examined at once with high powers (500 to 1,000 diameters, Zeiss apochrom., 2mm., oculars 4 and 8) certain corpuscles will be found containing two pale bodies of a pyriform outline. One end of each body is round and the body tapers gradually to a point at the other. They vary somewhat in size in different cases, but the two bodies in the same corpuscle are as a rule of the same size. They are from 2 to 4 μ in length and 1.5 to 2 μ in width at the widest portion. (Plate VI, Figs. 4, 5, 6.) Their tapering ends are directed toward each other and usually close together; their rounded broad ends may occupy various positions with reference to each other. They may be seen together with the axes of the bodies nearly parallel, or they may be far apart, the axes forming a straight line. (Plate V, Fig. 2.) The bodies themselves have a homogeneous, pale appearance, contrasting markedly with the inclosing red corpuscles from which they are sharply outlined. There is no differentiation into peripheral and central zone, no granular appearance of the body. Several slight variations in the appearance of these bodies at different times have been noted. The smaller forms are as a rule homogeneous; the larger forms are very frequently observed to be provided, in the rounded end of the pyriform body, with a very minute spherical body probably not more than 0.1 to 0.2 μ in diameter, which contrasts dark with the body itself. In several cases it manifested a brilliant luster with very high powers. (Plate VI, Figs. 4, 5; Plate VIII, Figs. 4, 5.) In the largest pyriform bodies there was seen in the center of the enlarged end a somewhat larger round or oval body which seemed to take the place of the smaller body or else be associated with it. This second body was from 0.5 to 1 μ in diameter. It changed its appearance with the focus. At a low position of the objective the parasite appeared dark with a light round spot in the enlarged end. At a higher position of the objective the inner body appeared dark, inclosed in the lighter pyriform outline. One or both of these bodies were observed in some of those forms undergoing amœboid changes.

A question of considerable interest to be discussed farther on is the relation of these two pyriform bodies to each other in the same corpuscle. Any direct mutual connection of their tapering ends is not demonstrable in the fresh preparation.

When exposed to a temperature of 35° C to 42° C on the warm stage*

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skin, because they have been occasionally encountered in masses on the slide. The incision perhaps dislocates such masses and the blood carries them out.

In stained preparations bluish spots are not infrequently found on red corpuscles which might be mistaken for parasites. They are nothing more than blood plates which have attached themselves during the drying of the film to the corpuscles. In general it may be said that such misinterpretations will not occur after the various stages of the microparasite have been once recognized.

* Pfeiffer's warm stage as constructed by C. Zeiss was used. The entire microscope is inclosed in the box (with the exception of ocular and adjustment screws). The heat is communicated to the heavy iron bottom of the box and thence to the air and the microscope stand which rests upon it. The drawback to this apparatus is the large amount of heat which is stored in the iron base and which may cause the temperature of the stand to rise faster than that of the surrounding air. As these observations upon the fresh blood had to be made mainly at the experiment station with no gas at hand, the heat was applied with an alcohol lamp and the thermometer carefully watched.

some of these bodies, by no means all, exhibited changes of outline. These may go on continuously in some bodies, in others quite slowly. The motion most frequently exhibited consists not so much of a thrusting out and withdrawing of pseudopodia as of a continual recasting of the general outline of the body as we find it for example in the leucocytes of mammalian blood. (Plate VIII, Figs. 1, 2, 3.) The changes of form may go on so continuously and so rapidly that it is not possible to sketch them all, as some escape observation during the sketching. The motion described does not of necessity require the stimulus of heat. During the past summer the same continuous rapid changes were observed in preparations of blood, sealed with paraffin, at 75° and at 85° F. In the former case the slide had been prepared at 10:45 a. m. The motion was still noticeable at 3:10 p. m., when the observation was discontinued. In the latter case the observation was discontinued six hours after the drawing of the blood, although the motion had not yet ceased. The sparseness of the microparasite in the blood makes it impossible to state definitely whether this amœboid motion belongs to a certain stage of its life. On the whole the observations tend toward the inference that the pyriform bodies do not change their form, and that the motion belongs to a younger stage. It should likewise be stated that the amœboid bodies observed were apparently single within the corpuscle.

If dried cover-glass films, heated, stained in alkaline methylene blue and decolorized, as described, be examined in water or balsam—preferably the former—it will be found that the forms described have become stained. The staining, however, is more feeble than in those microparasites found in the internal organs after death. It is limited usually to a zone on the periphery of the body, the center being feebly blue or entirely free from coloring matter. (Plate V, Fig. 2, 3*d*; Plate VI, Fig. 7.) In the latter condition it has been observed that these circulating forms have a peculiar luster, as if they possessed (in the dried and stained condition) feebly refracting powers. Other basic aniline dyes, such as methyl violet and gentian violet, are equally applicable. Fuchsine stains the organism, but also affects the containing corpuscle, so that the pictures obtained with it are not satisfactory. Hæmatoxylin likewise stains the organism fairly well. In general the clearest, most distinct pictures have been obtained with Löffler's alkaline methylene blue.

The intraglobular parasites found in the acute stage are not all pyriform and paired. In fact a considerable number as seen in stained preparations are somewhat irregular in outline and single. These are probably the bodies which were undergoing amœboid changes when they were dried in the film on the cover glass. Some of these irregular forms are shown on Plate V, Fig. 3.

The corpuscle which contains such a pair of microparasites has fully one-fourth of its area occupied by them. That this invasion is detrimental to the corpuscle is easily understood. In preparations of fresh blood the corpuscle has a peculiar appearance. Its margin is irregularly notched and creased, the border may be beset with projecting spine-like processes and its color may be darker than that of the normal corpuscle. It has, to use a fitting expression, a wrecked appearance. This change is more marked in some cases than in others. Such corpuscles have lost their characteristic flexibility. They retain their disk-like form, even after normal corpuscles have become shriveled and folded in preparations kept under observation for some time.

The number of infected corpuscles circulating in the blood during the high fever is usually quite small. It is difficult to make an approximate estimate without careful counting. Probably one or two in a single field of the 2-mm. objective, or from half to 1 per cent, is near the truth in most cases. In some, however, a long search is necessary before one is brought into view. When the number grows larger death is not far distant, and may be expected within twenty-four hours. Toward the fatal termination, there may be from 5 to 10 per cent of the corpuscles with the pyriform parasites present. Fig. 2 on Plate v is an illustration of a group of such infected corpuscles taken from the blood on the last day. Very rarely large numbers of parasites may be present and yet the animal recover. The only case of this kind is No. 49, in which hæmoglobinuria appeared at the same time. When present in considerable numbers in the blood the infected corpuscles usually appear in groups in the field of the miscroscope, as is shown in the figure referred to, and not uniformly distributed.

When the fever has subsided and the number of red corpuscles has been greatly diminished, the parasites disappear quite rapidly from the blood. In fact, the reduction of temperature usually coincides with the more or less complete disappearance of the infected corpuscles, and their place is then taken by the large number of embryonic corpuscles which begin to replace the losses. An occasional infected corpuscle may be detected for some days or even a week after recovery has set in. But they are so scarce that their detection is more of an accident. After the subsidence of the fever, when there is a general sinking of the vital powers, leading to death, the parasites may linger on in the blood in small numbers or they may disappear as in recovering cases.

Parasites in internal organs.—With only 1 or 2 per cent, or even 10 per cent, of infected corpuscles in the circulating fluid, it would be difficult to account for the enormous daily losses of blood corpuscles in the acute fever. The difficulty is cleared up by sacrificing an animal in the earlier days of the fever and examining the internal organs for infected corpuscles. Large numbers of parasites are found within corpuscles in the capillary blood of congested areas, such as those of the heart muscle and of the omentum. In the latter membrane there are delicate fringes containing capillaries which may be placed entire on a slide and examined with the highest objectives. In such capillaries in the fresh condition, with perhaps a little iodized serum added, the pale intraglobular parasite may be seen quite distinctly. When such fringes are torn and crushed on cover glasses and dried films prepared and stained, the large number of parasites is at once revealed. (Plate VI, Fig. 1.) The same may be said of the muscular walls of the heart. In these the smaller vessels are seen by the unaided eye to be engorged, and in sections the capillary network is found in the same condition. (Plate VI, Fig. 2; Plate VII, Fig. 1.) If a piece of such muscular tissue be compressed and dried films made from the blood squeezed out, an unusually large number of infected corpuscles will be found.* These statements are best illustrated by a case:

No. 163 was killed August 25, 1891, when her temperature was 107. On the morning of August 21 her temperature was still normal (101.6). It was not taken until August 24, when it was 106.8. If we assume that the first high morning temperature occurred August 22, she was killed at the end of the third day of continued fever. Even at this time there had been great losses in blood corpuscles.

August 13	5,000,000 in a cmm.
August 24	3,338,800 in a cmm.
August 25	2,645.000 in a cmm.

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*In such preparations, the falciform bodies of sarcosporidia cysts are frequently present, especially when the preparation is from a cow over 5 years old.

Before she was killed there were 2 to 3 per cent of infected corpuscles in the circulating blood. In the internal organs there were found in cover-glass preparations made at the autopsy—

In blood from skeletal muscles very few infected corpuscles.
In blood from the right heart very few infected corpuscles.
In blood from marrow of sixth rib very few infected corpuscles.
In blood from the left heart 2 to 3 per cent infected corpuscles.
In blood from lung tissue 2 to 3 per cent infected corpuscles.
In spleen pulp 5 per cent infected corpuscles.
In liver tissue 10 to 20 per cent infected corpuscles.
In kidney tissue 10 to 20 per cent infected corpuscles.
In hyperæmic fringes of omentum 50 per cent infected corpuscles.
In heart muscle 50 per cent and many free parasites.

This distribution of the infected corpuscles and their localization in the capillaries will receive more attention later (Plate VII). Meanwhile we simply wish to point out that, while only a few parasites may circulate in the blood, the infection may reach 50 and even more per cent in the internal organs. The parasites as they appear in the capillaries differ somewhat in form from those in the circulating blood. Their form may be best seen in dried and stained preparations of the capillary blood of the heart muscle. (Plate IV, Fig. 5.) They appear slightly smaller than in the circulating blood and the outline of many is spindle shaped or fusiform, *i. e.*, tapering at both ends. (Plate VI, Fig. 1.) In this stage, which is probably one of active growth, they stain very well. The stain is deeper in that half of the body directed towards its mate in the same corpuscle. Distinctly pyriform bodies are also present, and these as a rule take the stain quite uniformly. In preparations of fresh blood from the same source no differences are observed except an absence of the minute nuclear (?) body in this stage. It may be that we have to deal with forms younger than those which circulate in the blood. (See Fig. 3.)

Changes of form of an amœboid nature have already been referred to. If the organs of an animal which has been dead for five or six hours be examined it will be found that all the intraglobular parasites have a roundish form, and that distinctly fusiform or pyriform bodies are to be seen only occasionally in preparations from the heart muscle. (Plate V, Fig. 1.) The inference is that the microörganisms have assumed the spherical form under the adverse conditions presented by the death of the host. Similar changes are observed after a time on the warm stage. The pyriform and spindle-shaped bodies which have been thus far described may therefore escape the attention of those who study the blood and the organs after death only. The blood is rarely in a condition to be examined after death, because the corpuscles lose their disk-like form very speedily. In the various organs they are preserved fairly well even for hours after death.

The relative number of infected corpuscles in the internal organs demands some attention. This was estimated approximately in dried and stained cover-glass preparations after examining a large number of fields. The cover-glass films were made like those from the blood. A smooth, fresh incision was made into the organ, the cover glass gently drawn over the cut surface, and the film allowed to dry. This gave thin and uniform films. The very soft and partly disintegrated spleen pulp required some other procedure. A little of the pulp was scraped up with the edge of one cover glass and then quickly drawn over another, as in the preparation of blood films. This usually insured layers thin enough for microscopic examination.

A comparison of the various cases which have been examined shows that there is a considerable variation in the number of infected corpuscles found in the body after death, according as the animal succumbed in the fever stage, or after the number of red corpuscles had been greatly reduced and the fever had passed away. In the former case the infection is very extensive, as the following illustrations show:

No. 128 (Texas infection).

Blood from skin and heart, 10 to 20 per cent corpuscles contain parasites.
Blood from spleen, 10 to 20 per cent corpuscles contain parasites.
Blood from liver, 40 to 50 per cent corpuscles contain parasites.
Blood from kidneys, 80 to 90 per cent corpuscles contain parasites.

No. 130 (North Carolina infection).

(Number of corpuscles two days before death, 3,922,000.)
Marrow of rib, 5 per cent of corpuscles contain parasites.
Blood from skin and heart, 10 to 15 per cent corpuscles contain parasites.
Blood from spleen, 10 to 20 per cent of corpuscles contain parasites.
Blood from liver, 20 to 30 per cent of corpuscles contain parasites.
Blood from kidneys, 60 to 80 per cent of corpuscles contain parasites.
Capillary blood from heart muscle and omentum, 50 per cent of corpuscles contain parasites.

In those cases in which the number of corpuscles has fallen quite low, *i. e.*, below 2,000,000 before death, the number of such as are infected must necessarily be low, because there are so few corpuscles remaining. Of these the majority may be embryonic or new forms.

No. 134. (Temperature on the last day, 103.2; number of corpuscles, 1,822,500.)
Blood (subcutaneous and from heart cavities) contains ½ to 1 per cent infected corpuscles.
Spleen, 2 to 3 per cent infected corpuscles.
Kidney and liver, 20 to 30 per cent infected corpuscles.
Heart muscle, 10 to 15 per cent infected corpuscles.

No. 95. (Chronic case. Infection first detected August 7; killed in dying condition August 25. Blood corpuscles 1,858,800.)
Blood before death contains 5 per cent infected corpuscles.
Spleen contains 2 per cent infected corpuscles.
Kidney and liver contain 5 per cent infected corpuscles. The former organ also contains many free parasites.

These illustrations may suffice here to demonstrate the variable number of infected corpuscles found at the autopsy. As to their distribution over the body, something has already been stated. They are very abundant, as determined thus far, in the capillary blood of the heart muscle, but quite rare in that of the skeletal muscles. Of the internal organs the kidneys usually contain the largest number; not infrequently from 50 to 80 per cent of all the corpuscles are infected. (Plate IV, Fig. 4; Plate VII, Fig. 2.) Next comes the liver, then the spleen. In spite of the fact that this latter organ is loaded by several times its own weight with red corpuscles rarely more than one-tenth contain parasites. Infected corpuscles have been found in great abundance in the capillaries of the choroid plexus of the lateral ventricles of the brain and in the vessels of the pia and the brain substance. They have also been detected in the capillaries of the intestinal mucosa.

Freed parasites.—In view of such enormous destruction of red corpuscles the question naturally arises whether freed forms of the parasite are not regularly observed. In the circulating blood none have been seen. In the preparations from the heart muscle of various cases there are seen a large number of free bodies in pairs as they are found in the corpuscle. Unstained, they float in pairs in the blood under the cover glass, sometimes as pyriform, sometimes as round bodies. (Plate VI, Fig. 8.) They have a homogeneous grayish appearance. Whether there is at this time any organic connection between the pair by their tapering ends or simply by invisible remnants of the once enveloping corpuscle has not yet been made out. In some instances the shadowy outline of the corpuscle may still be seen around them. Motion has not been observed. The only other organs in which free bodies are found are the kidneys. (Plate VI, Fig. 3.) These organs are generally filled with infected corpuscles. In the fever stage we may find in dried films and in stained sections very few corpuscles which do not contain a pair of parasites. When the number of corpuscles has fallen quite low before death and the destruction has practically ceased there may still be found, in dried and stained films of the parenchyma, immense numbers of free parasites. They appear as roundish coccus-like bodies grouped in pairs and varying slightly in size, never as pyriform or fusiform bodies. To a casual observer they might appear as coarse granulations of broken-down cells and cell nuclei, but a little study and comparison of different cases soon dispels this view.

THE MICROÖRGANISM IN THE MILD TYPE OF TEXAS FEVER.

We have thus far considered only those forms of the parasite found in the acute type of the fever. This type will now be understood to be one in which there is a very rapid multiplication of the microparasite in the blood vessels corresponding to an equally rapid disappearance of the red corpuscles. The forms of the microparasite are pyriform and fusiform bodies chiefly intraglobular, occasionally free. The postmortem forms are roundish. In size the pyriform bodies are quite large, and the question arises, are there any smaller forms to be found? For these we must turn to the mild (usually autumnal) cases of the disease. It is an interesting fact that these cases are characterized by the presence of the smaller stages of the parasite. While the pyriform bodies are not entirely absent, they are very rare. In the acute type only the latter and not the former are seen.

In the mild type we have from 5 to 50 per cent of the red corpuscles in the circulating blood infected for a period of from one to five weeks. In the acute type, on the other hand, the circulating blood contains usually from one-half to 2 per cent of infected corpuscles; 10 to 15 per cent is a rare occurrence, usually just before death. In the fresh preparations of blood this small stage of the parasite is as a rule invisible. Rarely we may observe it on the very border of the corpuscle as a round pale spot about 0.5 μ in diameter, which does not change its place. When dried films of blood are stained in alkaline methylene blue the parasites appear as round coccus-like bodies from 0.2 to 0.5 μ in diameter and situated within the corpuscle on its border. They sometimes appear as if situated on the border, but outside of the corpuscle. As a rule only one is found in a corpuscle. (Plate IV, Figs. 1, 2, 3.) In many cases a division of the coccus-like body into two could be clearly made out. The separation was noticeable as a paler line and a constriction at either end similar to the division of certain micrococci. This division usually appeared in all bodies of a preparation from one case, but could not be noticed in any preparation of perhaps the next case.

These bodies stain as well as the larger pyriform bodies in basic aniline dyes and in hæmatoxylin. They do not stain in acid dyes, such as eosin or in Ehrlich's dye for neutrophile granules. When this stain is employed the corpuscles, beautifully tinted, show a small round unstained spot where the parasite is situated. When the dried films are treated with dilute acetic acid the corpuscles fade out, while these coccus-like bodies remain behind and stand out prominently.

It has already been stated that these bodies are characteristic of the mild, autumnal type of the disease. A glance at the appendix will show how numerous these cases may be. This stage of the parasite is there indicated provisionally as "peripheral bodies" or "peripheral coccus-like bodies." A more careful examination of these cases will reveal three groups:

(1) Animals exposed to Texas fever late in the season (October and November).

(2) Animals which have passed through an acute attack earlier in the summer (second attack or relapse in October and November).

(3) Animals which contract a mild disease during or previous to the season of the acute disease.

In the first group the disease is mild and may pass unnoticed. The corpuscles with peripheral bodies appear in the blood as the number of corpuscles begins to fall, and disappear when it again begins to rise. Rarely a corpuscle with a pair of large pyriform bodies is detected.

In the second group the phenomena are the same.

To the third group belong a few cases which showed a blood infection several weeks before the fever appeared among all the susceptible animals in the infected field. In two cases the infection was at first by peripheral coccus-like bodies. This, after a week's time, developed into an acute fatal infection, in which only the large forms were found after death. In another the infection by peripheral cocci was noticed as early as August 7. From 10 to 20 per cent of infected corpuscles circulated in the blood until August 19, when some large pyriform bodies made their appearance. The blood contained both small and large parasites until August 25, when the animal was killed in a dying condition.

In the foregoing it has been tacitly assumed that these intraglobular coccus-like bodies are living organisms. This position without further proof would undoubtedly be open to objection, and hence the reason for considering them parasites will be discussed somewhat in detail. In the foregoing chapter all those changes which the red corpuscles undergo as the result of anæmic conditions have been described. Certain corpuscles when dried and stained presented numerous granules which varied more or less in size, the largest rarely exceeding 0.5 μ. The coccus-like bodies resemble the larger granules very closely, and it might be argued that they are of the same origin. This is not so, however, for the following reasons: The coccus-like bodies appear *with or immediately before* the destruction of red corpuscles. The granules (or punctate cells) appear *after* the number has fallen below one-half the normal, and when the destruction ceases the punctate cells still persist or increase and the coccus-like bodies disappear. The coccus-like bodies are with rare exceptions included in normal corpuscles; the granules belong to the large new cells (macrocytes). As to the bodies themselves, they are all of the same size in the same preparation of blood, while the granules vary considerably in this respect. Again, the granules are present in considerable numbers in the same corpuscle, while the coccus-like bodies are present singly or in a state of division; rarely two are found in the same cell.

When dried films are treated with one-half of one per cent acetic acid the coccus-like bodies come out distinctly as the cell fades. The granules can not be made to appear in this way. Finally the punctate cells can be produced by artificial venesection, but the coccus-like bodies do not appear in the blood under this condition. The coccus-like bodies are thus of a character entirely different from that of the granules, although they take the same stain and appear together in the blood. (Plate IV, Fig. 3; Plate IX, Fig. 5.) Many of the same reasons will also apply in refuting the possible objection that they may be the result of disturbances of the blood other than those of a loss of corpuscles. Heinz * found certain bodies stainable in methyl violet appear on the red corpuscles of rabbits twenty-four hours after the subcutaneous injection of phenyl-hydrazin and its derivatives. These bodies are described as "strongly refracting spheres which are attached, button-like, to the red corpuscle. Often they are connected with it by a pedicle, or they may be entirely free in the plasma surrounded by a shred of protoplasm." In Texas fever the corpuscles containing the coccus-like bodies are always of normal form and appearance. It would be difficult to find reasons for believing them to be the result of some chemical action on the blood corpuscles. The ticks, which might be regarded as secreting a poison in their parasitic life, are very scarce on the animals during the autumn and early winter, when the mild type of disease prevails. When they are most abundant, during the period of the acute disease, the coccus-like bodies give way to the pyriform bodies.

If we admit their parasitic nature as highly probable we have still the question before us whether they are stages of the Texas fever parasite or of another parasite transmitted with it. This question can not be positively answered until, by methods akin to those of bacteriology, we shall be enabled to isolate the Texas fever organism and observe the transformation of one stage into the other, either in cultures or in the blood of inoculated animals. In the absence of such rigorous proof the presumption is nevertheless strongly in favor of the unity of this and the larger forms already described. We observe in the first place the appearance of both types of the disease in all outbreaks studied at the experiment station since 1889, though at different periods of the same season, the coccus-like bodies being associated chiefly with cool weather. An outbreak produced after the middle of September in 1889 developed cases containing the coccus-like bodies only. In one of these cases killed in a dying condition, the spleen and the liver were affected as in acute cases, but hæmoglobinuria was absent. Several cases were observed in which there is a transformation of the mild into the acute type with a corresponding change in the form of the parasite.

Perhaps the strongest proof that the coccus-like bodies and the pyriform, amœboid bodies are stages of the same parasite was furnished recently in an unexpected manner. Two cows inoculated with blood from healthy North Carolina cattle early in July, 1892, developed the acute type of Texas fever with the appearance of pyriform parasites within the red corpuscles. Both recovered, and the number of corpuscles was rising toward the normal, when, at the end of August, a relapse was detected in both animals. The number of corpuscles was rapidly falling again and many were infected with the coccus-like bodies. Reinfection from without can hardly be considered in these cases, as there were no ticks in the field and two control animals had normal blood throughout the season.†

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* Arch. f. path. Anatomie, CXXII, S. 112.

† Since writing this four other cases, inoculated in the same manner, have passed through a relapse.

THE PROBABLE LIFE-HISTORY OF THE MICROÖRGANISM IN THE BODY OF CATTLE.

We have thus far presented in a somewhat fragmentary manner the observations bearing upon this microörganism. It now remains to put them together in a way which will illustrate its probable development.

In the early stages of the high fever in a few acute cases, before the destruction of red corpuscles had gone far, very minute bodies were seen in fresh blood. Their form, so far as determinable (apochrom. 2 mm., ocular 8) appeared as an elongated figure of eight or two short rods attached end to end. They had a very active Brownian motion in addition to a movement which carried them from one place to another in the field. This latter movement may have been due to currents in the liquid. They could not be detected in preparations stained with methylene blue. That this is the free form which precedes the parasitic stage must remain at present a mere conjecture.

The (hypothetical) swarming or motile stage (intraglobular).—We have already (on p. 213) referred to certain very minute, well-defined, bright, frequently motile bodies seen within the red corpuscles of healthy cattle at various seasons of the year. As might have been expected, these bodies were found in Texas-fever blood as well. It has also been stated that they vary more or less both in size and form. The question has frequently presented itself, whether some of these bright motile bodies were the progenitors of the coccus-like and the pyriform bodies of the Texas-fever parasite. Inasmuch as they are present both in health and in disease, only a most trying examination of the blood in many cases could decide whether certain forms only appeared in disease or not. These bodies are so minute and so inaccessible that it is by no means certain whether such a prolonged study would bear fruit. In the course of these investigations such a study was impossible, and we have simply to present the facts that these bodies are present in health and disease and that they vary in size and form. In one case it was difficult not to accept the hypothesis that some of the bodies are a stage of the microparasite. In the blood of this animal these bodies grew in number with the peripheral coccus-like bodies and disappeared at about the same time. This view is presented simply to serve as a working hypothesis for such as are inclined to follow this phase of the subject more minutely. There is nothing in this hypothesis not in harmony with the positive observations concerning the Texas-fever microbe. Such a motile, swarming stage is one which can readily be conceived of as finding its way into the red corpuscle constantly in motion in the vessels of the body. Why it is not seen in every case may be explained by the same hypothesis which accounts for the presence of the peripheral coccus-like stage in the milder type of Texas fever. This hypothesis assumes a retardation in the intraglobular development of the micro-parasite by which the smaller stages remain long enough in the blood to be detected. If the retardation is still more pronounced, it is easy to conceive of the motile or swarming stage as circulating in the blood long enough to be detected.

The stage of the peripheral coccus-like bodies.—After the (hypothetical) swarm-spore has penetrated into the corpuscle it comes to rest, loses its bright, refrangent appearance, and attaches itself near the periphery of the corpuscle as a pale body which is only detected with difficulty in the unstained corpuscle. This body next undergoes division which is probably incomplete, for in the more advanced stages the two resulting bodies are as a rule still attached to each other. These remain close together while the infected corpuscle is circulating in the blood. This stage of the coccus-like body, like the preceding hypothetical stage, must be regarded as recognizable because of a retarded development of the microparasite. It is probable that this retardation of development in susceptible animals is due to meteorological conditions, such as low temperature of the air, and to partial immunity. In acute attacks the enormous multiplication of the parasite in the blood shows how rapid in such cases its development and how ephemeral these intermediate stages must be. The period of retardation may vary in length, but it seems probable that this stage may remain in the circulation at least several days.

The stage of the larger forms (pyriform and spindle-shaped bodies).—The two coccus-like bodies resulting from division begin to grow and assume fusiform outlines. It is probable that they remain attached to each other at least for some time, for in stained preparations a very delicate stained line may occasionally be traced passing from one to the other. In this stage they stain very well in hæmatoxylin and basic aniline dyes. As they continue to enlarge, the two members of the pair remaining always of the same size, a more elongated, pear-shaped outline is assumed, and in the unstained condition a minute dark particle is observed in the broad end of each body. Under conditions not definable a larger or smaller number of the red corpuscles contain but one body. These unpaired forms are found most abundantly in the circulating blood, where they may manifest amœboid changes.

The larger forms circulating in the blood do not stain so well as the somewhat smaller bodies found in the capillaries after death. This may be due to degenerative processes or to a transformation into some unknown reproductive state. The annexed figures illustrate, diagrammatically, the intraglobular stages of the Texas-fever parasite, *i. e.*, those forms which have only been found in the blood during Texas fever, and very rarely in Southern cattle.

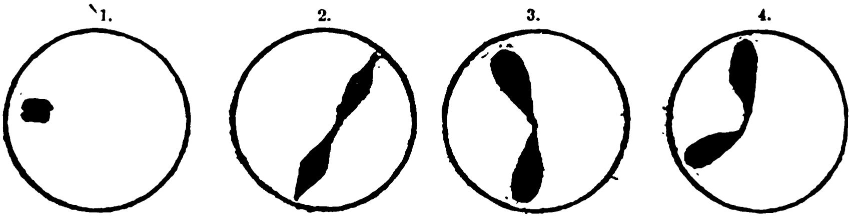

FIG. 3.—Intraglobular forms of the Texas-fever parasite. The shading shows the relative staining capacity with methylene blue. 1. The peripheral coccus-like body (0.6 μ long) in process of division (from the mild type). 2. Larger spindle-shaped forms from the capillary blood of the heart muscle. The free ends are but feebly stained. 3. Larger pyriform bodies from the same source staining entirely. 4. Pyriform bodies (2 μ long, 1.5 μ wide at the widest portion) staining but feebly; from the circulating blood. (The last three forms from the acute type.)

Free bodies.—These are set free after they have reached the preceding stage by the disintegration of the infected corpuscles. They may be found in capillary blood of the heart muscle in abundance. Their most common location is in the kidneys, however.

No forms which might be interpreted as reproductive stages have been recognized at any time in the many cases which have been studied. That the organism multiplies very rapidly in the blood of susceptible cattle is demonstrated by the fact that the injection of a small quantity of infected blood gives rise to the disease. How does this multiplication take place? There are two possibilities in view. Either the large pyriform body, while within the corpuscle or after it is set free, may enter the reproductive stage and produce a generation of very minute bodies akin to the motile, bright intraglobular bodies seen in fresh blood, or there may be a free reproductive phase, distinct from the intraglobular forms, taking place in the blood.

THE NATURE OF THE TEXAS-FEVER MICROÖRGANISM AND ITS RELATION TO THE PARASITES OF THE RED CORPUSCLES OF OTHER ANIMALS AND OF MAN.

It has been known since 1881 that the various types of malarial fever in man were accompanied by minute organisms living within the red corpuscles. This discovery by Laveran has been followed by confirmations in various parts of the world, and it is generally accepted that these intraglobular organisms are the cause of malaria. Stimulated by this important discovery, various observers have studied the blood of many animals (frog, turtle, and various birds) and have found therein certain minute parasites which likewise pass their life chiefly within red corpuscles. Much has been written upon the interrelation of these forms and their bearing on malaria in man. Nothing positive, however, has come of it, although there is a close resemblance between some of the parasites found in birds and those found in man. They all have in common the peculiar habit of living in the red corpuscles. Those of cold-blooded animals (frog and turtle) do not contain any pigment granules. On the other hand, those of birds and man do, as a rule, contain granules of dark pigment which is derived from that portion of the red corpuscle destroyed by them. These pigment granules are by some regarded as the more abundant the more retarded the growth of the parasite, and consequently the slower the destruction of the containing corpuscle. The parasites found in the blood of birds and man first appear as minute, slowly enlarging amœboid bodies in the red corpuscles. Soon pigment granules appear. When of a certain size these bodies break up within the corpuscles into a variable number of spores. These are set free and begin life as a new generation by entering other red corpuscles and undergoing the same development. These cell parasites are not associated with a visibly diseased state of the animals in which they are found. In man it is well known that certain kinds of fevers known as malarial are produced by them.

The Texas-fever parasite differs in many important respects from all those thus far described. Its morphology is quite unique. It contains no pigment. It probably runs through its whole development in a short time, otherwise it would be difficult to account for the rapid destruction of red corpuscles. Nevertheless, no distinctly reproductive phase has been seen during four years of observation of a great variety of cases.

It is hardly within the scope of this report to go into any details concerning the parasites of the red corpuscles of other animals and of man. The literature of this subject has now grown quite voluminous, although the progress made is not very great, owing to the limitations of methods. None of these cell parasites have thus far been cultivated according to bacteriological methods, and it is not likely that they ever will be. Inoculations of blood containing them seem to succeed only when they are made on the same varieties of the same species of animals, according to Celli and Sanfelice,* and even then success is limited to a small number of the cases inoculated. Observations are thus of necessity statistical and comparative rather than experimental, and must extend over a large number of cases before the significance of the various facts observed can be even formulated. Even then it is difficult to impart to others the conviction which comes from prolonged observation, while the desultory observations of many individuals lead to wide differences of opinion.

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* Fortschritte der Medicin, 1891. Nos. 12, 13, and 14.

Classification of the parasites of red corpuscles has been attempted by Kruse and others and the various forms indicated under the following scheme:*

Genus.	Species.	Variety.
1. *Hæmogregarina* (Danilewsky)	*H. ranarum*, Danil.	
	H. testudinis, Danil.	
	H. lacertæ, Danil.	
2. *Hæmoproteus* (Kruse)	*H. columbæ*, Grassi.	
	H. danilewsky, Kruse.	
	H. aluci, n. sp.	
	H. bubonis, n. sp.	
	H. passeris, Grassi	*a.*[1] *c.*
	H. noctuæ, n. sp	*a.* *c.*
	H. alaudæ, n. sp	*a.* *b.* *c.*
3. *Plasmodium* (Marchiafava et Celli)	*Pl. malariæ*, M. et C.	*a.* Quartanæ. *b.* Tertianæ. *c.* Quotidianæ.

[1] The letters refer to the relative rapidity with which the development goes on; *a* signifies slow; *b*, accelerated; *c*, rapid.

It seems improbable that the Texas-fever parasite will ever be ranged under any of these genera, and therefore a new genus has been created for it (*Pyrosoma*). The specific name (*bigeminum*) is derived from the peculiar character which this organism has of appearing in pairs within the red corpuscles. This name does not commit it to any special group of protozoan parasites, although it is not improbable that it may belong to the sporozoa to which most cell parasites belong. The peculiar pair of pyriform bodies within the red corpuscles might be homologized with the falciform bodies or crescents of the sporozoa, which in this case are without a cyst of their own and make use of the cell wall for this purpose.

The great rapidity with which this parasite multiplies in the system of susceptible cattle may perhaps be explained along lines suggested by R. Pfeiffer† in his observations on *Coccidium oviforme* and *C. perforans* in the rabbit. These two species of sporozoa (the former inhabiting the bile ducts of the adult rabbit, the latter the intestinal epithelium of the young rabbits), Pfeiffer maintains, are one and the same, which runs through a rapid entogenic development, with the formation of an immense number of individuals in the intestines of young rabbits, and thereby causes a severe (mostly fatal) disease, while in the adult it remains largely restricted to the liver, where it runs through a slow partial development, and the spore produced requires conditions only found externally for its further development. Applying these observations to the Texas-fever organism, we may assume some dual development of the parasite, one taking place in susceptible, the other in insusceptible animals. Or the conditions may be much simpler in the latter, and depend largely on a simple repression of the multiplication of the parasite in the red corpuscles, owing to some unknown modifications of these bodies.

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* Loc. cit., No. 14.

† Beiträge zur Protozoen-Forschung. I. Heft.

PROBABLE ACTION OF THE MICROÖRGANISM IN THE BODY OF SUSCEPTIBLE ANIMALS.

This topic has been touched upon in the foregoing chapters, but only in a desultory manner, and the known facts are brought together here in a more compact form. The demonstration of the microörganism in the organs does not present any special difficulties. The organs were examined fresh or after being in the ice-chest for twenty-four hours, both in teased preparations and in sections. The teased preparations as well as the sections were examined in iodized serum to avoid any injury to the blood corpuscles. For the same reasons the sections were prepared with the razor and not on the freezing microtome. In such thin sections, or in teased preparations, some of the capillaries frequently remained intact, and the microörganisms could be made out as pale, roundish dots within the red corpuscle. Plate VII, Fig. 3, is drawn from an unstained teased preparation of the fresh spleen. Tissues were hardened both in strong alcohol and in Müller's fluid and alcohol, according to the usual procedure. The staining presented some difficulties, and in general the aniline dyes did not give satisfactory results. Hæmatoxylin in the form of Ehrlich's acid hæmatoxylin has proved very satisfactory in bringing out the intraglobular parasites. In tissues hardened in Müller's fluid the outer layers showed a peculiar modification of the parasites. Instead of appearing as blue bodies, they assumed a brownish-red color. This was especially noticeable in tissues which are very delicate, such as the choroid plexus. In these all the parasites appeared brownish-red instead of blue. This may be due to the action of the Müller's fluid. Tissue hardened in alcohol, while it demonstrates the intraglobular bodies very distinctly, does not preserve the corpuscles so well.

The destruction of red corpuscles by the microparasite within them is the main fact in the pathology of Texas fever. There are, however, some secondary phenomena associated with this destruction, which account, in part at least, for the peculiar lesions of this disease. The infected corpuscle remains in the circulation as long as the contained parasite is below a certain size. Thus, in the mild autumnal form of the disease the number of circulating corpuscles invaded by the coccus-like bodies is rarely below 5 per cent, commonly from 10 to 30 per cent, and at times near 50 per cent. The corpuscles are not changed in form or size, and in fact the parasites are very small when compared with the size of the corpuscle, and only brought out distinctly by staining. When the parasite has reached a certain size we may assume that the corpuscles lose their flexibility and adaptability to the minute channels or capillaries and become lodged in them, forming emboli, so to speak. The capillary becomes obstructed, and red corpuscles are wedged in behind the infected ones. It is highly probable that at this time a favorable opportunity is offered to the free, earliest stage of the microorganism to attack the remaining corpuscles, otherwise it would be difficult to understand why capillaries are frequently found which contain, to all appearances, only infected corpuscles. It may be that other factors come into play, such as the changed specific gravity of the infected corpuscles, by which their relation to the blood plasma becomes changed and in virtue of which they act as foreign bodies in the vessels. Whatever may be the reason, the fact remains that the paucity of infected corpuscles in the blood taken from the large vessels and the heart is counterbalanced by a very extensive infection of the corpuscles found in the capillaries. The smaller the capillary the higher the percentage of infected corpuscles. In the white substance of the brain, the capillaries in a section were sometimes found completely filled with red corpuscles and every corpuscle was infected. Similarly, capillaries have been observed both in sections of hardened tissue and in teased preparations of fresh tissue from the spleen, kidneys, intestinal mucosa, omentum, plexuses of the brain, heart muscle, and red marrow of the ribs, which were either completely or partly filled with infected corpuscles alone.

This capillary plugging or embolism may account, to some extent at least, for the enormous distention of the spleen and for the degenerative changes of the parenchyma of the liver. The perinephritic sanguinolent œdema so frequently observed on post-mortem examination is probably due to the complete filling up of the vascular system of the kidneys with infected and uninfected corpuscles. Similarly the ecchymoses in the calyces of the pelvis may be accounted for by this condition.

Another phenomenon of interest is the remarkable injection of all pathological growths of a vascular character, such as old fibrous adhesions and pleuritic fringes. Similarly vascular fringes found on the omentum covering the paunch, and on the origin of the large vessels at the base of the heart, appear as dark red spots. Here microscopic examination shows the same abundant infection. The intense injection of the vascular plexuses of the brain cavities is associated with extensive infection within the capillary network. This injection of the entire capillary system of the body may be largely aided by the presumable rise of blood pressure which must take place after the enlargement of the liver and the engorgement of the spleen and kidneys practically shut these organs out of the general circulation.

While the skeletal muscles show but slight infection, the heart muscle is severely involved. Probably owing to the smaller caliber of its capillaries and the constant contraction of the muscular walls, a favorable opportunity for the lodgment of infected corpuscles is afforded. In the capillaries of the heart muscle the infection of corpuscles is always very great, and freed forms of the parasite are abundant. The capillary plugging will account for the almost constant ecchymoses of the external and internal surfaces of the ventricular walls.

The breaking up of the infected corpuscles probably takes place in the capillaries over the entire body, for, as stated above, freed parasites are found in the capillaries of the myocardium after a certain period of fever. This leads to the presence of free hæmoglobin in the blood (hæmoglobinæmia). This condition was strikingly demonstrated in the case of a fetus about three months old taken from a cow which had succumbed in the acute stage. The amniotic fluid had a beautiful wine-red color. It is probable that many infected corpuscles, which break away from the capillary plugs are carried into the kidneys, where the final dissolution takes place. Otherwise it would be difficult to account for the usually enormous numbers of free as well as intraglobular parasites which are found in the kidneys toward the end of the fever.

The hæmoglobinuria observed in nearly all acute cases may be due in part to a transudation of the hæmoglobin dissolved in the blood, in part to the destruction of red corpuscles in the kidney itself. The same may perhaps be true of the material transformed into bile by the liver. This organ is, as a rule, heavily infected, though not to the extent observed in the kidneys. The bile contains to all appearances a very large quantity of bile pigment. This may be derived in part from the dissolved hæmoglobin in the general circulation and in part from the corpuscles undergoing destruction in the capillaries of the liver itself.

The cause of the high temperature in the later stages of the fever, when the pathological changes are well under way and the blood is loaded with the débris of corpuscles and free parasites, may not be open to discussion. In the earliest stages, however, the explanation of waste products in the blood does not seem to follow in every case. In a few the fever was high, although there was no apparent reduction of red corpuscles. It must be stated that in view of the fluctuations to which the number of corpuscles is subject the counts in these cases may be somewhat misleading. Yet on the whole the initial fever seems to be caused by something other than the destruction of the red corpuscles, and we may invoke two possible causes, leaving their determination to more accurate continued observations on single cases. These are the multiplication of the parasite in the blood, perhaps independent of the corpuscles and the thrombosis of capillaries in the nerve centers.

The question of a cyclical destruction of red corpuscles corresponding to the different generations of parasites is an interesting one, but the observations put on record in the appendix do not give us any definite information. In acute cases after the first few days the fever is continuous, or nearly so, and does not indicate any intermission or remission of the acting cause. Whether the individual generations follow one another so rapidly, or whether there are a number of generations intermingled, has not been determined. To the eye there is more or less uniformity in the size of the parasites observed in any given case throughout the body. They may be all minute in the stage of the coccus-like bodies, or they may all be unusually large, or they may all be in a stage intermediate between these extremes. It should be stated, however, that in a few cases the fluctuation in the destruction of the red corpuscles was regular enough to suggest a period of from one and a half to two weeks in such cases.

What becomes of the microparasites in those cases which recover? We have already signalized the setting free of the parasites and their accumulation in large numbers in the kidneys. Further than this the observations do not go. The parasites are perhaps destroyed by a combination of circumstances, one of which is the small number of red corpuscles finally left for infection. Thus in blood containing only one and a half to two million red corpuscles fully one-half are enlarged, embryonic forms which may not be so well fitted for the growth of the parasite. Another circumstance may be the unfit condition of the blood due to the presence of the very débris which the parasites have aided in producing.

OUTBREAKS IN WHICH THE TEXAS-FEVER PARASITE HAS BEEN DEMONSTATED.

The parasite of Texas fever, or more particularly the coccus-like and the larger pyriform stage of this microörganism, have been demonstrated in the following outbreaks:

(1) In the spleen of a case from an outbreak in Virginia, September, 1886.

(2) In the organs of cases from an outbreak in Maryland, September, 1888.

(3) In the blood and the organs of cases from an outbreak on the experiment station (North Carolina infection), August to October, 1889.

(4) In the blood and the organs of cases from an outbreak on the experiment station (North Carolina infection), September to November, 1889.

(5) In the blood and the organs of cases from an outbreak on the experiment station (North Carolina infection), August to November, 1890.

(6) In the blood and the organs of cases from an outbreak on the experiment station (Texas infection), August to October, 1890.

(7) In the spleen of a case which died in North Carolina, June 29, 1891.

(8) In the blood and the organs of cases from an outbreak on the experiment station (North Carolina infection), August to November, 1891.

(9) In the blood of a case from an outbreak in Pennsylvania, November, 1891. (Specimens of organs and urine sent by George Jobson, jr., v. s.)

(10) In the organs of a case at Fort Smith, Ark., March, 1892. (Preparations sent by R. R. Dinwiddie, v. s.)

(11) In the organs of a case produced by the intravenous inoculation of blood from North Carolina cattle, July, 1892.

(12) In the organs of cases from an outbreak produced at the experiment station in the usual way by North Carolina cattle, August and September, 1892.

(13) In the organs of cases from an outbreak in New Jersey, August, 1892.

(14) In the spleen and blood of cases from an outbreak at Camden, N. J., August, 1892. (Specimens sent by Drs. Miller and Sellers.)

In Nos. 7 and 13 there were the usual lesions (hæmoglobinuria, etc.,) observed by Dr. F. L. Kilborne at the autopsies. In No. 9 there were the usual fatty degeneration and bile injection of the liver and hæmoglobinuria. The diagnosis of Texas fever was thus assured in all the outbreaks mentioned.

THE PRODUCTION OF TEXAS FEVER IN CATTLE BY THE INOCULATION OF BLOOD FROM CASES OF THIS DISEASE.

The demonstration that Texas fever is caused by a certain microörganism is not absolutely made by showing that it is always associated with this disease and not observed in health. It may be argued that such bodies are the concomitant rather than the cause of the fever. Nevertheless it may be said that no microörganism constantly associated with a given infectious disease has yet been found which is not demonstrably or presumptively the cause of the disease. Hence the probability that the microparasite described is the cause of Texas fever is very high, although the demonstration can not be made until such organism can be cultivated in some manner outside of the animal body and inoculations made with pure cultures. There is nothing to-day to encourage us in the hope that parasites so highly adapted as the one under consideration will ever submit to the crude culture methods successful with many bacteria.

The high probability that we have the cause of Texas fever before us is increased by the fact that when blood from cases of this disease is injected into the circulation of healthy susceptible cattle, the disease is produced and the microparasite appears in the blood under the same conditions under which it becomes manifest in the natural disease. There is still the possibility before us that the microparasite is transmitted in the diseased blood and that some unknown agent has been transmitted with it which is the true cause of the infection. It is useless to discuss this further, and each reader must form his own opinion of the value of the experimental evidence adduced in this report.

Before quoting our experiments in the production of the disease, a few observations on the attempt of others to produce it are in order.

Dr. D. E. Salmon in 1880 (4, p. 303), made a number of inoculations with tissues and fluids taken from cases of Texas fever, some of which were successful:

(1) November 7, 1879. Calf 6 to 8 months old inoculated subcutaneously with bile and blood kept ten days in a sealed pipette. No result.

(2) September 14, 1881. Yearling inoculated subcutaneously with 5 cm^3 blood from a case dead three or four hours. No result.

(3) September 29. Yearling bull inoculated subcutaneously with 5 cm^3 blood containing some spleen pulp, which had been kept twenty-two hours in sealed pipette.

(4) Red cow inoculated as No. 8; also drenched with a mixture of blood, urine, and bile.

(5) Heifer received a subcutaneous injection of 5 cm^3 of bile.

(6) Bull 3 years old drenched with one ounce of urine.

(7) Steer 2 years old drenched with one ounce of bile.

(8) Cow received 5 cm^3 of urine under the skin.

Of the cases from Nos. 3 to 6, inclusive, No. 3 and No. 4 reacted with a high temperature and No. 4 became very weak and emaciated. In 1883 (5, p. 34) three additional experiments are reported. A steer and a heifer, 2½ years old, received August 7 subcutaneous injections of spleen pulp suspended in water. The spleen pulp had been kept in a sealed tube for seven days. Neither animal became affected. A third animal, a cow which had been inoculated subcutaneously with fresh splenic pulp, October 3, was taken sick in ten days and died three days thereafter. There were evidences of hæmoglobinuria. Two young animals drenched with the same splenic pulp did not become seriously affected.

A number of additional inoculations were made with cultures of a micrococcus cultivated from the spleen of a case of Texas fever with negative results in all cases.

Dr. Billings gives the notes of a case inoculated with cultures of what he regards as the Texas fever bacterium (8, p. 100). We have already commented on this case. In this connection it is sufficient to say that the proof of Texas fever has not been brought in this case, although it should have been above reproach, since it is supposed to establish the etiology of Texas fever. The observations in this report show that there is no Texas fever without a marked reduction in the number of red corpuscles. This is the essential sign of Texas fever. Secondary to this are lesions of liver, spleen, and kidneys, and hæmoglobinuria and the presence of embryonic corpuscles in the blood. There is nothing in the autopsy notes as published by Billings to demonstrate the presence of Texas fever in the absence of red water. It is also curious that in his experiment the young animal of 5 months should take the disease more severely than the "large red cow," since calves are proverbially resistant.

In the report of Paul Paquin (9, p. 46) we find the following statements:

> Texas fever is transmissible not only from Southern stock to susceptible Northern cattle, but under favorable circumstances is inoculable *between Northern natives*, although in the ordinary course of things in our climate transmission does not occur. We have inoculated native Missouri cattle with spleen and liver pulp from *other diseased natives* and produced typical cases of Texas fever, but it took large doses of virus. The rapidity of the course of the malady depends much on the origin and age of the virus. It was more rapid from old pulp kept in warmth and properly preserved than it was from virus of fresh matter, and it seems impossible to cause severe *Texas* fever with *fresh* urine, whilst the same exposed to warmth awhile becomes dangerous.

There are no experiments reported to convince the reader of the truth of these statements, though the direct transmission of disease from Southern cattle and sick natives to susceptible cattle by inoculation has been confirmed by us. Why old spleen pulp and old urine should be more dangerous, excepting as producers of septic conditions, is by no means clear. We should believe the contrary. We have no information at all as to how the inoculation was made, or any to show that the inoculated animals did contract Texas fever, excepting the bare statement that the inoculations were successful.

R. R. Dinwiddie (10) made subcutaneous inoculations upon four different animals with fluids and tissues from cases of Texas fever. We are glad to see the experiments reported, so that they may be estimated at their true value. The inoculations were made with fresh urine, spleen pulp kept over night, with bile kept in a sealed pipette, and with a culture of a micrococcus from the liver of a case of Texas fever. These inoculations proved negative. A fifth animal which received spleen pulp kept over night as a drench remained well. We have no reason to doubt the accuracy of these results. The negative outcome may have been due to the fact that only young animals were used, and that the season was perhaps too far advanced for experimental cases to succeed.

In all of these experiments the uncertainty of the conclusions reached as regards the negative results must be evident to all who have read the foregoing part of this report. Many of the cases which to all appearances were not affected may have passed through a mild attack, recognizable only by the microscopic examination of the blood corpuscles and a determination of their number.

Our own experiments were made mainly with fresh material, and this was injected under the skin and into the blood directly. Nine inoculations were made in all.* We shall in this place only refer to the important points in each of the following special cases:

(1) On September 1, 1890, No. 111, a heifer about 21 months old, received into one of the jugular veins 13 cc. of whipped blood. This was obtained from No. 128, which had just died, and in whose blood there was a large number of infected corpuscles. The defibrinated blood was kept in a warm chamber at 35° C. for three hours before the injection. An examination of the table compiled shows a decided fall in the number of red corpuscles on the thirteenth day, and several days thereafter a considerable number of new red corpuscles (macrocytes) were found in the blood. There can be no doubt that this was a mild case of Texas fever. The subsequent gradual weakening of this animal and death three months after the inoculation could not be accounted for.

(2) On September 16, 1890, a similar injection with defibrinated blood was made on No. 142. The blood was taken from the heart of No. 90 about one-half hour after death, and, after defibrinating, it was kept at 35°–40° C. for one and one-half hours before it was injected. In the table was observed a marked fall in the number of red corpuscles at three different times from two to three weeks apart. The animal fully recovered subsequently. Neither of these cases would probably be considered conclusive evidence that the disease can be reproduced in this way. The seven following cases will dispel any doubt on this point.

(3) On September 19, 1891, a portion of the heart muscle of No. 181, just dead, was pounded in a mortar with sterile normal salt solution. The resulting reddish fluid was filtered and injected into the jugular vein of No. 182, after standing in a warm chamber for about one hour. The table compiled in this case leaves no doubt as to the nature of the disease. The temperature rose on the sixth day in the evening, and a high evening temperature was observed for ten days thereafter. A high morning temperature was first noted on the eighth day, and the fever remained continuously high for at least four days thereafter. The number of blood corpuscles had fallen from 6,000,000 to 2,000,000 eleven days after the inoculation. The Texas-fever parasites were found in the blood. The animal fully recovered subsequently.

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*Five additional cases of Texas fever were produced with the blood of healthy North Carolina cattle (page 264).

(4) On the same day blood was withdrawn from the jugular vein of No. 181, then still alive, and injected at once into the jugular of No. 185. The whole operation lasted one or two minutes. Of this blood, which contained at the time perhaps one-half to one per cent infected corpuscles, two syringefuls, or 28 cc., were injected. The disease produced in this animal was severe enough to leave no doubt as to its nature. The evening temperature was high on the third day and was low again on the ninth day. The continuous high temperature lasted four days. The number of blood corpuscles had fallen from 5,000,000 to 2,000,000 on the tenth day. The Texas-fever parasites were found in the blood. The animal fully recovered subsequently.

(5) No. 186 was treated precisely as No. 185, at the same time. A very severe case of Texas fever was the result. The temperature and the loss of red blood corpuscles were the same as in No. 185 (see page 182 for curve). On the ninth day she could scarcely stand, and was trembling and quivering over the whole body. A syringeful of blood was withdrawn at the time from a jugular vein for other inoculations, and the operation was followed at once by convulsions and death. The very advanced lesions of the liver and spleen, the dark red, port-wine-colored urine, and the immense number of infected corpuscles in the various organs, made this case one of the most severe of the season.

In 1892 four cows were inoculated with blood obtained from a case of the disease. All became affected within a week and three died. The more important facts in connection with these inoculations are reproduced here.

On August 27 blood was withdrawn from the left jugular vein of No. 222, then suffering with the disease. In the blood a small number of large intraglobular parasites were found. The skin over the jugular was shaved and washed with 0.1 per cent mercuric chloride and the vein opened with a scalpel. The blood was caught in sterilized bottles, containing glass beads, and defibrinated by shaking vigorously for ten minutes. The bottles were kept in a water bath at 40°–42° C. The injections were performed not longer than fifteen to twenty minutes after the withdrawal of the blood from No. 222.

(6) No. 197, a cow 6 years old, received into the left jugular 14 cc. (one syringeful) of this blood.

(7) No. 277, a cow 11 years old, received under the skin of the neck ½ cc. of the same blood in four different places, *i. e.*, 2 cc. in all.

(8) No. 228, a cow 7 years old, received subcutaneously ½ cc. in two places, *i. e.*, 1 cc. in all.

No. 197 died quite unexpectedly September 4, eight days after the inoculation. The temperature had been high since August 31. The autopsy left no doubt as to the nature of the disease.

No. 227 died September 9, thirteen days after the inoculation. The temperature had risen and other symptoms of disease had appeared September 2. On the day of death the red corpuscles had fallen to 1,500,000. The autopsy revealed the usual lesions of Texas fever in a very marked degree. The urine was visibly free from hæmoglobin. The small number of red corpuscles just before death indicated that the period of hæmoglobinuria was past.

No. 228, which had received the smallest dose, reacted as promptly as the foregoing, with a high temperature. The usual symptoms appeared, but more tardily, and the animal finally recovered. On September 14 the red corpuscles numbered 1,500,000. From this time there was slow improvement in the condition of the blood.

(9) One bottle of the defibrinated blood with which the preceding

animals had been inoculated was placed in a refrigerator at an average temperature of 50° F. (10° C.) from August 27 until August 30. On this day 14 cc. (one syringeful) was injected into the left jugular vein of No. 200, a cow 8 years old. After five days of elevated evening temperature and two of continuous high temperature, this animal succumbed September 8. The organs presented the usual lesions of Texas fever. The urine had a dark port-wine color. In the various organs and the blood many infected corpuscles were detected.

With these positive results before us we need not hesitate to make the statement that there is something in the blood of the cattle during Texas fever which, introduced into the body of healthy susceptible cattle, gives rise to the disease. This something is capable of reproducing itself indefinitely in the blood of susceptible animals. In all cases there had been multiplication of the Texas-fever parasite, and these inoculations furnish additional proof that this parasite may be regarded as the cause. These inoculations show, also, that a comparatively small quantity of blood from diseased cattle placed under the skin is capable of causing a severe and even fatal infection. In this respect the microörganism seems to have as powerful an effect as the bacteria which produce acute fatal forms of septicæmia, and seems to be capable of almost equally rapid multiplication. The sojourn of three days in a refrigerator did not destroy the vitality of the microörganism as it exists in the blood. The very severe inoculation disease produced in 1891 and 1892, as compared with 1890, is partly to be accounted for by the fact that only old animals were used latterly, while in 1890 the animals were young. The observations made in the field experiments and by former observers, that the susceptibility seems to increase with age, provided there has been no exposure to the disease at any time in life before, is thus indirectly confirmed by inoculation. The very striking susceptibility of cattle to this disease was furthermore demonstrated by the intravenous inoculation of three guinea-pigs at the same time with three of the cases cited above (Nos. 6–8, inclusive). These animals remained perfectly well, though they had received relatively to their body weight a very much larger quantity of the defibrinated blood.

THE INOCULATION OF ANIMALS OTHER THAN CATTLE WITH TEXAS-FEVER BLOOD.

The inoculation of animals other than cattle had a twofold purpose: first, to determine whether other domesticated animals are likely to become infected with the microparasite and perhaps cause the dissemination of Texas fever, and, second, to find some small animal to take the place of the much more costly cattle in the study of the parasite and the disease. This was especially desirable, since this parasite can not be cultivated outside of the animal body.

Sheep.—Since sheep and cattle are so closely related it was thought that the disease might perhaps be induced in them. For this purpose a lamb was used. A syringeful (7 cc.) of blood was drawn from the right jugular of cow No. 184, which was very sick at the time, and whose blood contained the microparasite in small numbers, and injected at once into the left jugular vein of the lamb. The operation was performed October 1, 1891; the blood contained 10,442,000 red corpuscles in a cubic millimeter. No parasites of any kind were detected in them.

October 13.—Red corpuscles 8,282,000. Nothing abnormal detected.

October 27.—Red corpuscles 11,538,000. Several bright intraglobular bodies seen in the fresh preparation, but no parasites.

From October 1 to October 27 the temperature was taken twice daily. It fluctuated between 101 and 103.

Though the inoculation was made somewhat late in the season the outcome plainly indicates no susceptibility of sheep to this disease.

Rabbits.—September 20, 1889, immediately after cow No. 54 had been killed, a quantity of spleen pulp containing many corpuscles infected with large paired parasites was mixed with sterile salt solution. The reddish liquid was injected into the ear vein of three rabbits. No rise of temperature and no symptoms of disease were noticed. One rabbit was killed, on the seventh day and the blood and organs carefully examined for infected corpuscles with negative result. The others were watched for several months, but nothing abnormal detected in their action. The second rabbit, which had become scabby, was killed January 18, 1892. The various organs and the blood were examined microscopically with negative result. The following may also be cited:

October 1, 1891.—With the blood of cow No. 184 two rabbits (Nos. 140, 141) were inoculated at the same time with the lamb. Each received 1 cubic centimeter into the ear vein.

No. 140 (black rabbit) showed no external symptoms of disease. The blood was examined twice and no infected corpuscles found.

October 19, 1891.—6,537,000 red corpuscles in a cubic millimeter.

December 3, 1891.—7,134,613 red corpuscles in a cubic millimeter.

No. 141 (white rabbit) remained equally well. The following blood examinations were made:

October 19, 1891.—5,268,000 red corpuscles in a cubic millimeter.

December 3, 1891.—4,533,000 red corpuscles in a cubic millimeter. Infected corpuscles absent.

Pigeons.—September 28, 1891. Blood containing infected corpuscles is drawn from the jugular vein of cow No. 186 and injected at once into the wing vein of three pigeons (Nos. 2, 3, and 4). In a fourth pigeon (No. 1) the blood failed to enter the vein and was deposited in the surrounding connective tissue. Each received about 1 cc.

No. 1 died October 13, though not from the inoculation, as its feathers were ruffled at the time of the operation and it was probably not well at that time. Examination of the blood and organs negative. The other pigeons remained well. On October 5 the blood of No. 3 contained 3,926,800, that of No. 4, 4,094,300, red corpuscles, in a cubic millimeter. They were killed January 22, 1892. The blood of No. 3 was searched in vain for parasites.

Guinea-pigs.—August 27, 1892. Blood was drawn from the left jugular of cow No. 222, affected with Texas fever, into sterile wide mouthed bottles containing glass beads and defibrinated by shaking vigorously. Three guinea-pigs were inoculated: No. 1 received into the exposed jugular 1 cc. of defibrinated blood; No. 2 received into an ear vein ½ cc.; No. 3 received into an ear vein 1 cc.

The injections were completed fifty to seventy minutes after the blood had been drawn from No. 222. The injection into the ear vein was a perfect success in the two cases on which it was tried. These guinea-pigs remained entirely well. The blood was examined from time to time both in fresh and in dried and stained preparations, but the corpuscles were not counted, owing to the pressure of other work. There was no evidence, however, from the microscopic examination, of any change from the normal condition or of any infection. The guinea-pigs were watched for more than a month after the inoculation.

Strongly contrasting with the result on guinea-pigs is that obtained with the same blood on cows. The largest quantity injected into the circulation of the guinea-pigs was relatively to the body weight not less than twenty-five times greater than the largest dose, and three hundred times greater than the smallest dose injected into the cattle. Yet all four cows contracted Texas fever and three died.

Of other observers who have tried to produce Texas fever in other animals we find Paquin (9, p. 46) making the following statement: "We have succeeded also, though with great difficulty, to induce the disease in sheep, guinea-pigs, white mice, white rats, and very rarely rabbits, kittens, and swine. The germs may be reproduced by inoculation of liver and spleen pulp in any of these subjects, but the quantity must be large and the gross typical spleen lesions are not always to be found." Inasmuch as spleen lesions are associated with a variety of infectious and septic diseases in animals, and as there is no record of other lesions peculiar to Texas fever in these inoculated animals, we are compelled to call in question the accuracy of the diagnosis in these cases.

The inoculations made by us demonstrate that sheep, pigeons, rabbits and guinea-pigs are to all appearances insusceptible to this disease, whereas in cattle the disease may be invariably produced by the injection of infected blood. It is to be hoped that opportunity will be presented the coming summer to try other species of animals.

THE TRANSMISSION OF TEXAS FEVER BY MEANS OF THE CATTLE TICK.

Boöphilus bovis (Riley) Curtice.

It has been a more or less prevalent theory of cattle-owners in the districts occasionally invaded by Texas fever from the South that ticks are the cause of the disease. Mr. J. R. Dodge, (2) in his historical report of this plague, mentions the fact that in 1869 an outbreak in Chester County, Pa., was believed to be caused by ticks. Gamgee in 1868 (2) states: "The tick theory has acquired quite a renown during the past summer, but a little thought should have satisfied anyone of the absurdity of the idea." The officers of the Metropolitan Board (1, p. 1084) and most subsequent observers seem to have entertained the same view of the harmlessness of the cattle tick as a carrier of the infection. In fact, few observers have given it any thought. In the entire report of F. S. Billings we find no reference whatever to these pests. Paquin (9, p. 45) states that he has "found the parasites also in *ticks bloated with blood of infectious Southern cattle.* So this must be added to the list of sources." But the ubiquity of this "germ" rather predisposes one against any belief in its existence if we did not have sufficient positive evidence that bacteria have nothing to do with the disease. The statement thus depends simply upon the finding of a "germ" in adult ticks resembling that found in diseased cattle, and in fact everywhere else (waters, soil, manures from the South, urine, bile, liver, spleen, kidneys, etc., of infectious Northern stock). Experiments to demonstrate the relation which ticks bear to Texas fever were not made.

Nothing positive was thus contributed to the elucidation of the action of ticks in carrying the disease until the subject was taken up at the Experiment Station of the Bureau near Washington, in 1889. Here it was found by experiments to be detailed in the remainder of this report that the disease can be produced by ticks hatched artificially in the laboratory, without the presence of Southern cattle. Before giving in detail the experiments which led up to the final determination of this important discovery a few facts concerning the cattle tick which have come under our observation are necessary for the information of the general reader. We do not propose to give anything more than a general account of the tick, leaving problems of biology and morphology to those pursuing special lines of work in this field.

THE CATTLE TICK (*Boöphilus bovis*).

[Plate x.]

The first description of this parasite was made by Prof. C. V. Riley, in 1868, under the name *Ixodes bovis* (2, p. 118):

> *Ixodes bovis* Riley.—A reddish, coriaceous flattened species with the body oblong-oval, contracted just behind the middle, and with two longitudinal impressions above this contraction, and three below it more especially visible in the dried specimen. Head short and broad, not spined behind, with two deep, round pits. Palpi and beak together unusually short, the palpi being slender. Labium short and broad, densely spined beneath. Mandibles smooth above with terminal hooks. Thoracic shield distinct, one-third longer than wide, smooth and polished; convex, with the lyrate medial convexity very distinct. Legs long and slender, pale testaceous red; coxæ not spined. Length of body 0.15 of an inch; width 0.09 of an inch.*

The generally accepted idea as to the harmlessness of this parasite caused it to be neglected as an object of study until 1889, when our preliminary experiments seemed to indicate that ticks must be present to convey the infection from Southern to Northern stock. Hence, Dr. Cooper Curtice, at that time in charge of the investigation of animal parasites, began the study of the life history of this species.† It was discovered quite accidentally that adult females kept confined in bottles or other glass receptacles always lay their eggs. Such a stock of eggs furnished the starting point of Dr. Curtice's investigations. The eggs were placed in covered glass dishes containing a little soil and kept in a warm place. After a period of three to four weeks the young ticks appeared. These were placed on a calf kept in an artificially heated stable, as the season was already advanced (November 15). The earliest or larval stage as it emerged from the ovum had three pairs of legs. After one week's sojourn on the calf it was ready to moult. The emerging nymphal stage was provided with an additional pair of legs. After another week's life on the calf the tick was ready to moult a second time and become sexually mature. Curtice thus showed that in this particular species there are two periods of moulting before the parasite becomes matured. He likewise created for it a new genus (*Boöphilus*). Dr. George Marx has given more or less attention to the classification of ticks, and places the species under consideration as follows:‡ Class, *Arachnida;* order, *Acari;* suborder, *Cynorhœsta;* family, *Rhipistomidæ;* genus, *Boöphilus;* species, *bovis*.

In our experiments with this cattle tick we have confirmed and extended the observations recorded above chiefly in the direction of the life history, since this is the most important aspect in its relation to Texas fever.

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* We simply quote this description here as a matter of historical interest, without comment as to its accuracy. We may state, however, that the color of adult females is not reddish. The back is olive brown, the belly slate colored. The dimensions given in this diagnosis probably belong to an adult male. For the dimensions of the parasite in its different stages, see this chapter.

† The biology of the cattle tick. Journ. of Comp. Medicine and Veterinary Archives. July, 1891, and January, 1892.

‡ Proc. Entomological Society of Washington, II, p. 232.

The laying of the eggs may be observed by anyone by simply placing full-grown ticks in some vessel from which they can not escape. The tick remains quiet for from two to four and one-half days, according to our observations; then a few eggs will be observed on the mouth parts, which gradually increase in number. The period of oviposition varies somewhat. Confined in bottles, for instance, at a temperature of 68°–78° F. the laying was observed to continue from eight to fifteen days in a lot of 23 mature ticks, each one of which was kept in a separate bottle. The number of eggs varies in general with the length of the egg-laying period. Those which took the longest time laid the largest number. Of 4 large ticks laying from twelve to sixteen days, each averaged 118 mgr. ($1\frac{13}{16}$ grains) of eggs. Careful counting gave an average of 1,300 eggs per grain. If we take the actual weight of all the eggs laid by the 23 ticks, which is 2.41 grams ($37\frac{1}{8}$ grains), a single full-grown tick averages about 2,100 eggs. Ticks do not need to be fully gorged with blood before they are capable of laying eggs. Even such as are half-grown will begin to lay after a few days, but the number is much less than that laid by the large, gorged individuals. Tests showed that 40 half-grown ticks laid no more eggs than would have been laid by 7 or 8 full-grown individuals. During the process of oviposition the female slowly shrinks in size, and when it is completed she appears shriveled and not more than one-half or one-third her former size. The eggs appear as dark, brownish-red masses of oval bodies. The color varies somewhat, and its depth appears to be connected somehow with the quantity of blood with which the female is gorged before oviposition. Measurements of freshly laid ova in 1889 made the long diameter 0.519 mm., the transverse 0.38 mm. Measurements in 1892 gave nearly the same figures, 0.496 and 0.384 mm. They are thus, roughly speaking, one-fiftieth of an inch long and one sixty-sixth of an inch broad at their widest portion.

When masses of ova are placed in glass dishes with a little soil or some leaves and a few drops of water, and the dishes kept closed with glass covers so that the emerging young may not escape, the incubation goes on without any difficulty. The period required for the young to emerge from the shell varies very markedly with the surrounding temperature. In Curtice's first experiment it required from three to four weeks. The temperature of the bacteriological culture room where they were kept could not have been lower than 70° to 80° F. at that time. This relation to temperature is well exemplified in the following experiments:

(1) Ticks sent from North Carolina and received here July 29, 1890, have laid a considerable number of eggs on the way. These are placed in glass dishes and kept in the laboratory. Many young ticks moving about on August 13. Here the period of incubation was from fifteen to eighteen days. The weather during this time was very hot.

(2) Eggs two to three days old placed in glass dishes August 8. Young ticks appeared August 29. Period about twenty-four days.

(3) Eggs several days old placed in dishes August 13, 1890. Young ticks appear in large numbers September 4 and 5. Period approximately twenty-five days.

(4) On September 17, 1890, eggs two to three days old placed in glass dishes. Young ticks first appear October 24, and their number increases until October 28. Period about forty days.

(5) Eggs one to three days old are placed in glass dishes September 20, 1890. Young ticks present in abundance November 1. Period about forty-three days.

(6) Eggs one to three days old are placed in glass dishes September 23, 1890. Young ticks begin to appear November 1. Period about forty days. The eggs from experiments 4, 5, and 6 were taken successively from the same adult ticks. The temperature of the laboratory at this time was 75°–80° F. during the day, but fell 5° or 10° at night.

(7) Eggs one to two days old placed in dishes October 6 and 9, respectively. The dishes were kept on shelves several feet above a steam heater. On November 9 all eggs were found hatched out. Period about thirty days or less.

(8) Eggs two to four days old placed in dishes October 9, 1890. Over steam register only a part of the time. A few young ticks appeared November 15. Hatching completed November 17. Period about thirty-eight to forty days.

From these recorded dates it will be seen how essential a high temperature is for the rapid development of the embryo in the egg. The period of development may vary from fifteen days to six or seven weeks, and may perhaps be prolonged still more by lower temperature. It is evident, however, that a certain temperature level exists below which no development takes place. In the experiments above described there was considerable daily fluctuation in the temperature, and hence they can be made to show only the general relation subsisting between heat and development. To find the lowest temperature at which development may go on would require thermostats in which a certain low temperature could be constantly maintained. It is probable that the shortest period of incubation might be shortened still more by placing the eggs in continuous high temperatures. We have considered this matter more in detail, because of the intimate relation between the period of development of the young tick and the so-called "period of incubation" of Texas fever.

There are some changes which the ova undergo during development which are visible to the naked eye. After a variable number of days each ovum presents a white spot. Under the microscope this corresponds to the position of the cloacal opening, and is nothing else than a mass of white powder composed of very minute spherical crystals. It is an excretory product (urates ?) of the young tick, the outlines of whose body and limbs are now visible through the shell under a low power of the microscope. The color of the egg itself becomes lighter, and of a more opaque, milky character. Towards the end of the period of development it assumes a peculiar metallic luster. These changes are all caused by the changes going on within the shell.

The minute six-legged ticks (Plate X, Fig. 3) after emerging from the shell are at first of a pale brownish, translucent, waxy color, which soon changes into an opaque brownish hue. They are about 0.67 mm. (.0268 inch) in length, including the mouth parts. They move actively about, carrying in their cloacal opening the chalky mass of urates (?) mentioned above. They collect along the edge between dish and cover, and scatter as soon as the cover is removed. When confined for some time in the dish, this becomes soiled with a large number of white dots discharged by the ticks.

These minute creatures are very tenacious of life when kept confined in glass dishes containing a little loam or some leaves. Young ticks hatched about the middle of December, 1890, were confined in the same glass dish in the laboratory during the winter. On May 1, 1891, four and a half months after hatching, they were still active. On May 19 a few were still active; some were inert, but not yet dead. Young ticks hatched about July 20, 1891, were still active August 29. The parasitic habit of the tick is probably so complete that no growth and no further development takes place unless the larvæ gain access to cattle. When they have once attached themselves to the host and begin to get nourishment in the form of blood their growth is assured.

We have already referred to the larval and nymphal stage, so-called, as observed by Curtice. In his observations each stage occupied about a week, so that at the end of two weeks the female tick is sexually mature, prepared to become fertilized, swell up and drop off to lay her eggs as the beginning of another generation. When young ticks hatched within a few days of one another are placed on cattle they do not necessarily mature at the same time. The dropping off of ripe ticks may go on some days before the animal is completely freed. In general, the time required for the tick to mature and drop off is from twenty-one to twenty-three days. These figures are the result of numerous observations made in the experiment fields at the station. The date being known when the larvæ were placed on the cattle, this period was easily determined.

The life history of the tick after it has attached itself to cattle is thus easily told. Taking two weeks for the tick to become sexually mature, the fertilization takes place as described by Curtice. An examination of the skin of cattle at this time shows each female provided with a male. After fertilization the female enlarges very slowly until from the nineteenth to the twenty-second day, when she swells up very rapidly, a day or two producing great change in size. When the proper stage is reached she loosens her hold upon the skin and drops to the ground, where the laying of eggs begins in a few days. The length of time elapsing between successive generations of ticks may be tabulated approximately as follows:

	Days.
From oviposition to the larval stage (period of incubation)	20 to 45
From larval to adult state (parasitic stage)	21 to 23
Age of one generation	41 to 68

It should be borne in mind that the young, after emerging from the egg, may perhaps live on the fields an indefinite length of time before they gain access to cattle. We have kept them alive for several months. How they would fare under the varying conditions of moisture and dryness and of a fluctuating temperature we are unable to state, from lack of observation. This free-living period must be added to the total given above to obtain a more accurate idea of the life of a single generation. Yet it is of little importance and without doubt very brief, for when cattle are within accessible distance the young ticks soon find their way to their host.

The problem how the tick passes the winter is an important one which needs special investigation. In the warmer climates ticks are found on cattle during the winter season, and hence the development from the egg goes on during the entire year. It is highly probable that in those regions where the temperature falls too low for the tick to live on cattle the species is carried through the winter in the ovum. The great vitality of the ova is illustrated in the following experiment:

A number of dishes containing eggs were placed in a cold storeroom in the attic of the Department building during November and December, 1890, and January, 1891. The eggs were placed on the bottom of the dishes, which, otherwise empty, were covered with glass covers. They were occasionally inspected in the course of the winter and early spring, but not thereafter until July 15, 1891. It was then found that in three out of nine dishes (one placed there in November, one in December, and one in January) the embryos had developed and hatched at the approach of hot weather, but were now dead. The young ticks had left behind the little chalky masses of urates (?) over the inner surface of the dishes. In the other dishes the eggs were shriveled. Signs of development were absent. This shows that the ova lived through the winter under unfavorable conditions of moisture, since the air of the room was quite dry. The capacity of the tick to survive occasionally the winter in regions north of its natural habitat was demonstated in an unexpected manner on the station grounds in 1891. In September of 1890 ticks hatched in the laboratory were placed on two cows in a piece of woodland belonging to the station, but some distance removed from it. These contracted the disease in due time. One died during the acute attack, the other succumbed after it. The ticks matured from this case, wintered over, probably, among the leaves under the trees, and on September 1, 1891, one young animal in this inclosure was found with many ticks attached to it, and the examination of the blood demonstrated Texas fever. The other animals in the inclosure were insusceptible Southern animals, kept over from previous years, but likewise infested with ticks. Since it is quite impossible that any ticks could have been taken to this inclosure during the summer of 1891, the explanation given above is the only admissible one. The ticks did not reappear in 1892.

Aside from the relation which the tick bears to Texas fever as the carrier of the microöganism of this disease, it is pertinent to inquire in this place what other injury this parasite might inflict on cattle. That it abstracts a certain quantity of blood during the later days of its parasitic existence is evident. The intestine is distended with a dark-red, tarry, viscid mass, from which an abundant crop of hæmin crystals may be obtained according to the well-known method of adding a crystal of common salt and some glacial acetic acid to some dried contents of the tick's body cavity on a glass slide and heating the latter until bubbles of gas are given off. These crystals show that there is much concentrated coloring matter of the blood corpuscles in the body of the tick. Yet it is doubtful whether in the aggregate very much blood is abstracted by the ticks, and the various cases under observation did not warrant the conclusion that any marked impression was made on the number of red corpuscles of insusceptible or recovered cases.

The tick produces more or less inflammation of the true skin and subcutis where it is attached. Sections of skin examined under the microscope show a very intense cell infiltration at the place of attachment, and for several millimeters around it. This infiltration is not noticed by the unaided eye. It is probable that it is due to the irritation caused by certain unknown secretions of the tick, which aid it in working its way through the upper layers of the skin and in obtaining blood in an uncoagulated state from the blood vessels attacked by it. After having attached themselves, ticks are in communication with blood vessels, for in removing them a drop of blood oozes from the place of attachment.

The young ticks attach themselves by preference to the more tender regions of the hide, such as the inner aspect of the thighs, the pubic region (escutcheon), and around and on the udder. When numerous they may attach themselves to the neck, the sides of the thorax, the ears, and even the back. In searching for them the regions first mentioned must be thoroughly examined. It must also be borne in mind that when the disease appears the ticks are still quite small and may be overlooked. Even at the time of death only a small number may have passed beyond the second molt. The ticks still within the second skin are only 3.2 mm. (about one-eighth inch) long. Those just emerged are of the same length. The more active males of the same stage are only 2 mm. (one-twelfth inch) long. The largest ticks found on animals which die during the acute attack are not more than 5 to 8 mm. (one-fifth to one-third inch) in length. When ready to drop off from insusceptible or recovered cases, they are about half an inch long (12 mm. long, 7 mm. broad, and 4 mm. thick).

In the foregoing it has been stated that the female tick remains until maturity upon the same animal to which it attached itself after emerging from the egg. Each tick, in other words, is parasitic upon but one animal. What becomes of the ticks not yet matured, which are attached to the skin of natives when the latter succumb to Texas fever, we can not state definitely. It is certain that they do not at once leave the dead body, for in the case of cattle which die early in the night the ticks are still found attached next morning. In the case of a calf kept in a large refrigerator several were found attached forty-eight hours after death. If ticks are removed by the hand from the dead body it will be found that the males as well as those females which have passed through the second molt move about with some show of activity, while those individuals which have not yet cast off the molted skin are motionless. Taking these facts into consideration, we must regard the movement of ticks from one animal to another as an unnatural process which, so far as we know, may take place, but which from general observation does not appear to be of much importance. Still, it is nevertheless desirable that experiments be made to determine positively whether ticks may be transplanted after the last molt, and whether at this advanced stage in their life history they are still capable of producing Texas fever.

Paquin states (9, p. 45) that full-grown ticks contain the "bacteria" of Texas fever. In order to see whether ticks contain bacteria, and what kind, the following inoculation experiments were made:

(1) *July 7, 1890.*—A large North Carolina tick was taken and its back scorched through with a red hot platinum spatula, thus exposing the body cavity. A loop of the black tarry contents transferred to peptone bouillon. A coccus, arranged in the form of tetrads, produces a faint cloudiness and a deposit in the inoculated tube.

(2) A second tick from the same source treated in the same way. The culture contains a coccus of the same form.

(3) *July 10, 1890.*—From a large tick from Texas cattle a peptone bouillon tube inoculated. Remains sterile.

(4) Another large Texas tick used. The resulting peptone bouillon culture contains a flocculent growth of large bacilli in chains.

(5) *July 18, 1890.*—An agar tube inoculated from a large tick, as before. Remains permanently sterile.

(6) Another agar tube inoculated from another tick. A considerable number of small colonies develop, having an opaque center and translucent periphery. They are made up of short bacilli.

(7) A peptone bouillon tube inoculated from a large tick becomes clouded with large motile spore-bearing bacilli.

These experiments show that the tick may harbor a variety of bacteria or none at all.

FIELD EXPERIMENTS TO DETERMINE THE PRECISE RELATION BETWEEN THE CATTLE TICK AND TEXAS FEVER.

These experiments were begun in the summer of 1889, and have been continued up to the present. They have been carried on in three different directions:

(1) Ticks were carefully picked from Southern animals, so that none could mature and infect the ground. The object of this group of experiments was to find out if the disease could be conveyed from Southern to Northern stock on the same inclosure without the intervention of ticks.

(2) Fields were infected by matured ticks and susceptible cattle placed on them to determine whether Texas fever could be produced without the presence of Southern cattle.

(3) Susceptible Northern cattle were infected by placing on them young ticks hatched artificially, *i. e.*, in closed dishes in the laboratory.

These three lines were not followed simultaneously, because, for instance, the fact that the disease can be produced by placing young ticks on cattle was discovered in 1890, and hence only tried then and thereafter. In giving the details of the various experiments we shall adhere not to the classification given above, but rather to the chronological order in which the experiments were performed. This is necessary in order to describe successively the experiments of the same year, which were more or less connected with one another, and also to show the process by which the various facts concerning the cattle tick came to our knowledge.

The disease was introduced into one field each year by North Carolina cattle brought here for this purpose. In 1890 a field was infected by cattle from Texas.

The field experiments were all conducted on the experiment station of the Bureau of Animal Industry, within half a mile of the limits of the city of Washington. The arrangement of the various experimental fields is shown for each year on a plat of the station grounds. The isolated condition of the field in use in any given season may be seen by an inspection of these plats. They are either separated from one another by a piece of ground remaining permanently free from infection, or by a lane or by a strip of ground purposely fenced off between them. No two fields in use are thus separated merely by a fence. In every case, with the exception to be noted, a strip of ground intervenes which is at least 36 feet wide. A small brook passes through a portion of the grounds, as is shown in the various plats, and the space between the fields along this brook is about 20 feet wide.

EXPERIMENTS OF 1889 (FIRST SERIES).

To carry on the experiments in the early part of the season of 1889, seven head of cattle were collected in Craven County, N. C., which is a portion of the permanently infected territory. On June 25 they were shipped by steamer from New Berne, N. C., and they arrived at the station near Washington June 27. They had thus been two days on the way. These animals were rather thin and a large number of cattle ticks (*Boöphilus bovis*) in various stages of development were attached to them. Only a few were full grown.

Experiment 1 (exposure to Southern cattle with ticks).—Of these seven head four were placed in field I (see Fig. 4) on the day of arrival, June 27. The field contains about nine-sixteenths of an acre. The soil is a dry, gravelly loam. A small stream passes through it, from which the cattle obtain their drinking water.

The history of the native cattle placed in this field may be briefly summarized.

(*a*) North Carolina cattle with ticks:

No. 12, placed in this field June 27, removed August 17.
No. 40, placed in this field June 27, removed August 17.
No. 42, placed in this field June 27, removed August 17.
No. 45, placed in this field June 27, removed August 17.

(*b*) Native cattle:

June 27.—No. 7 (cow, 6 years) placed in this field. Dead* August 23.
June 27.—No. 8 (cow, 1¼ years) placed in this field. Killed† August 27.

---

* Unless otherwise stated the cause of sickness and death is Texas fever.

† With one exception (No. 163) all native animals reported killed in this report were in a dying condition at the time.

June 27.—No. 75 (calf of No. 8, 4 months) placed in this field. Recovered.
June 27.—No. 9 (bull, 1¼ years) placed in this field. Died August 31.
June 27.—No. 10 (calf of No. 7, 4 months) placed in this field. Died August 31.
June 27.—No. 11 (calf of No 7, 4 months) placed in this field. Killed Sept. 10.
August 20.—No. 46 (heifer, 1¾ years) placed in this field. Killed September 10.
August 24.—No. 43 (steer, 3 years) placed in this field. Dead September 13.
August 24.—No. 44 (steer, 4 years) placed in this field. Dead September 17.
September 6.—No. 53 (heifer, 1½ years) placed in this field. Recovered.
September 6.—No. 54 (heifer, 2 years) placed in this field. Killed September 20.
September 14.—No. 57 (cow, 9 years) placed in this field. No result.
September 30.—No. 70 (steer, 2½ years) placed in this field. Died October 19.
October 19.—No. 71 (heifer, 3½ years) placed in this field. Probably no disease

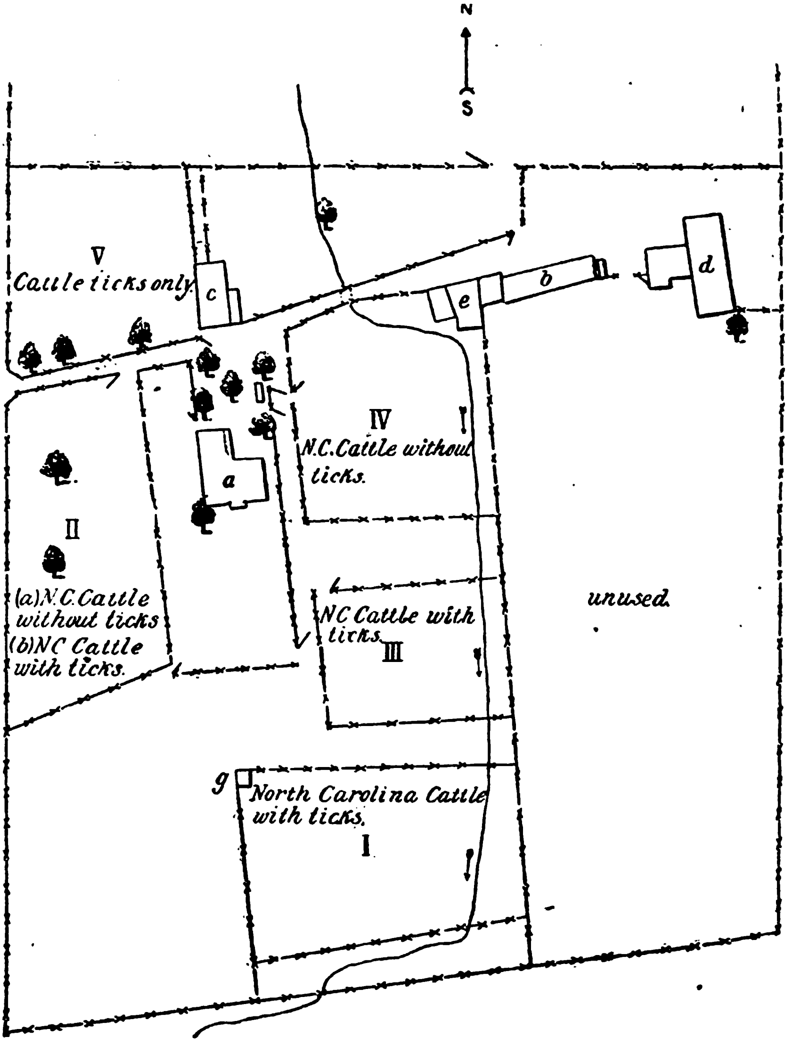
N
S
V
Cattle ticks only.
c
e
b
d
IV
N.C. Cattle without ticks.
a
II
(a) N.C. Cattle without ticks
(b) NC Cattle with ticks.
NC Cattle with ticks.
III
unused.
g
North Carolina Cattle with ticks.
I

FIG. 4.—Field inclosures for 1889 (scale, ½ inch = 33 feet).

a, dwelling house; *b*, station laboratory; *c*, horse stable; *d*, cow stable; *e*, breeding pens; *f*, tool house; *g*, shed in field.

The disease in this field was designed to furnish material for general investigation as well as to serve as a control for experiment 2 below.

It illustrates admirably a number of important characters of this remarkable disease and demonstrates once again the frequently observed fact that cattle, to all appearances healthy, may become the cause of an extensive fatal disease when transferred in the warmer seasons of the year from a certain permanently infected area to territories north of this area.

The first high morning temperature appeared August 15, or thirty-nine days after the native and Southern cattle were placed on this field together. The first death occurred August 23, or forty-seven days after this same date. In other words, the cattle exposed at this time died not less than forty-seven days after the beginning of the exposure. After a certain time, however, death follows more speedily after exposure, as may be seen when we consult those cases exposed August 20 and thereafter, for which this period was only fourteen to twenty-three days. The field remained infected so as to cause death as late as October 19. The later the exposure the less likely is the disease to end fatally.

Omitting the last case, No. 71, as having been exposed too late, we have ten deaths from thirteen cases exposed, or 76.8 per cent. It should be noted that, although the Southern cattle were removed from the field August 17, the infection on the field remained unimpaired.

Experiment 2 (exposure to Southern cattle without ticks).—For this experiment, field II was selected (see Fig. 4). The soil is the same as that in field I, but there is no running or standing water in it. It contains one-third of an acre.

This experiment differed from the first in that the *ticks were carefully picked from the three North Carolina cattle left after stocking field* I. The picking was done by hand. On July 6 and 17 the cattle were again carefully inspected, and any ticks which had thus far escaped attention were carefully removed. On July 23 no more ticks could be detected. In this way it was expected that no ticks would mature and infect the field. The following cattle were placed in this field June 27, 1889:

(*a*) North Carolina cattle without ticks, Nos. 28, 29, and 30.

(*b*) Native cattle: No. 51 (cow, 3 years); No. 52 (calf of No. 51, 4 months); No. 53 (heifer, 1½ years); No. 54 (heifer, 2 years).

On September 6, no ticks and no disease having appeared in this field, Nos. 53 and 54 were transferred to field I. Their further history is given under experiment 1. It would have been more satisfactory to have left these animals on this field until the close of the season of 1889. But the evidence is decidedly in favor of the assumption that there was no infection of these animals when they were transferred to the infected field. This evidence is twofold: (1) The three adult animals and one calf in control field I were dead by August 31, and the remaining calf was killed in a dying condition September 10. Hence all five animals exposed at the same time in the field containing ticks were either dead or very sick on the date of the removal of these two to field I. They on the other hand were at this time to all appearances healthy. (2) One transferred case (No. 54) was dying of an acute attack September 20, as the autopsy notes and microscopical observations demonstrate. If this animal had been affected September 6, at the time of transfer, the blood corpuscles would have shown later on enlarged and stained forms (macrocytes) always associated with prolonged disease. No. 53 first showed external signs of disease in the last week of September, at which time it lost much flesh and was very weak. In October it was passing through a mild or secondary attack. Both transferred animals, therefore, must be regarded as having contracted Texas fever after September 6, on field I. The same arguments apply to Nos. 51 and 52 which were reëxposed later on in the season (experiment 4).

EXPERIMENTS OF 1889 (SECOND SERIES).

In September of 1889 a second series of experiments were carried on in order to repeat the observations on the relation of ticks to Texas fever. Nine head of cattle were collected in Craven County, N. C. Three were taken from each of three farms located several miles from New Berne, and in opposite directions from that city. The three cattle from one farm were shipped from New Berne September 10, and reached the station September 14. The remaining six were shipped September 12, and arrived September 15. The three of the lot to arrive first were placed in their respective fields a day earlier than the remaining six. All cattle were well loaded with cattle ticks, many of which were nearly matured.

Experiment 3 (exposure to Southern cattle with ticks).—For this experiment field III was chosen (see Fig. 4). It resembled field I in having a running stream and contained about three-eighths of an acre. It was separated from field I by a lane 36 feet wide. The experiment was designed as a control to the others below, and in order to insure the same conditions in every respect one of each of the three lots of cattle was placed in it. The following animals were in this field:

(*a*) North Carolina cattle with ticks:

No. 113, placed in field III September 14.
No. 60, placed in field III September 15.
No. 62, placed in field III September 15.

(*b*) Native cattle:

No. 35 (heifer, 2 years), placed in field III September 14.
No. 47 (cow, 3¼ years), placed in field III September 14.
No. 49 (heifer, 3 years), placed in field III September 14.

Of these three natives only No. 47 passed through a severe attack of the disease, as the notes in the case demonstrate. The season was somewhat too far advanced when the exposure began, and of the new generation of ticks only very few appeared on the native cattle afterward.

Experiment 4 (exposure to Southern cattle with ticks).—This experiment is the counterpart of experiment 3, excepting that it was conducted in field II, which is without running water. Field II, moreover, was occupied by Southern cattle without ticks in July and August, as will be seen by referring to experiment 2. From this experiment there remained in the field natives Nos. 51 and 52. On September 14 and 15, three North Carolina animals, one from each of the three lots, were placed in this field, and one native, No. 56, was added September 14. There were, therefore, in this field on September 15—

(*a*) North Carolina cattle with ticks, Nos. 32, 61, and 67.

(*b*) Native cattle:

No. 51 (from experiment 2). Passed through the disease and recovered.
No. 52 (from experiment 2). Passed through the disease and recovered.
No. 56 (steer, 2¼ years). Probably not affected.

On October 9, ticks had almost entirely disappeared from the Southern cattle, and very few young ticks subsequently appeared on the natives.

Experiment 5 (exposure to Southern cattle without ticks).—For this experiment field IV was chosen (see Fig. 4). It covers about three-eighths of an acre, is situated above field III, and separated from it by a lane 36 feet wide. The stream passes through it on the east. Three Southern cows, one from each lot, were placed in this field after the ticks had been carefully picked off so far as they could be seen. In this field there were the following animals:

(*a*) North Carolina cattle without ticks:

Nos. 55, 59, and 63, the first put on the field September 14, the others September 15.

(*b*) Native cattle:

No. 41 (heifer, 4 years), placed in this field September 14.
No. 50 (cow, 3 years), placed in this field September 14.
No. 97 (calf of No. 50, 2 months old), placed in this field September 14.
No. 66 (heifer, 1½ years), placed in this field September 14.

The Southern cows were reëxamined September 18, 26, October 1 and 9, and some remaining ticks removed. On October 9 only two or three were found. Up to November 27 no ticks were detected on the native cattle, and no symptoms of disease were noticed.

Experiment 6 (*exposure to cattle ticks only*).—This experiment was carried on in field V, an inclosure consisting of about three-eighths of an acre. The soil is a heavy clay loam, and contains neither running nor standing water. On September 13 several thousand, mostly full-grown ticks, were scattered over the ground in this field. These ticks had been collected from cattle near New Berne, N. C., September 9 and 10. There were placed in this field, September 14, four natives:

No. 48 (cow, 2½ years).
No. 83 (calf of No. 48, 2 months).
No. 64 (steer, 2½ years).
No. 65 (heifer, 2½ years).

Of these, Nos. 48, 64, and 65 contracted Texas fever. No. 83 was not examined as to its blood, but it showed no external symptoms of disease. No. 48 was killed in a dying condition, October 21. The autopsy, as well as the examination of the blood before death, demonstrated Texas fever. Nos. 64 and 65 recovered.

SUMMARY OF THE EXPERIMENTS FOR 1889.

The first series (Nos. 1 and 2) go far toward demonstrating that a field must be infected with ticks before Texas fever can appear among natives. The second series confirms the first as far as it goes. The advanced season gave rise only to what has been called the mild or autumnal type of the disease, characterized by the presence in the blood corpuscles of the peripheral coccus-like stage of the Texas-fever parasite. If we bring together the results of the four experiments we find that in the field containing the ticks only, and in which Southern cattle at no time entered, all three exposed adult natives took the disease. In the field containing Southern cattle from which the ticks had been picked no disease appeared. Finally, in the two fields which contained Southern cattle and ticks together three out of six natives became diseased. In these experiments the great importance of the method of blood examinations as described in the first part of this volume is plain. To rely solely upon external symptoms in mild attacks is out of the question. The counting of the red corpuscles, the changes going on in the latter, and the presence of the Texas-fever parasite as determined by microscopical examination are indispensable in determining whether Texas fever is present or not.

EXPERIMENTS OF 1890.

The experiments of this year were chiefly occupied with the relation of ticks to Texas fever. The experiments of last year were repeated, and in addition ticks were hatched artificially and placed on cattle with the result that Texas fever appeared in every case (experiments 12 and 13). Southern cattle were obtained as before from North Carolina (Experiment 9) and also from Texas (Experiment 8).

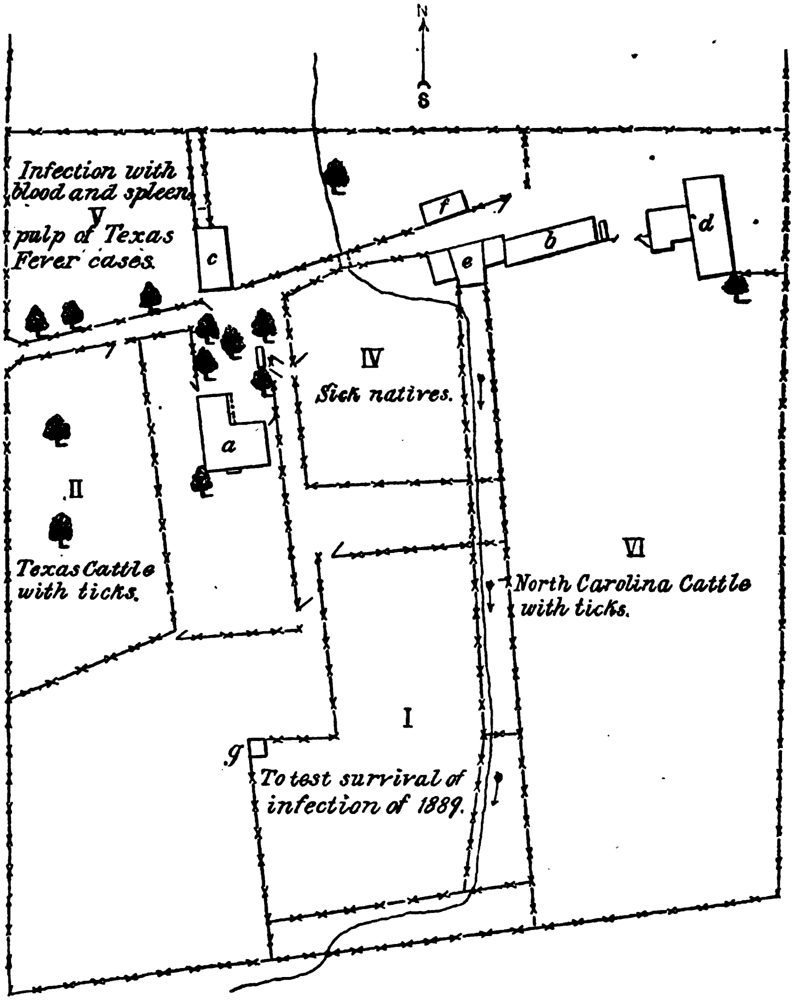
N
S
Infection with blood and spleen pulp of Texas Fever cases.
V
c
f
b
e
d
IV
Sick natives.
a
II
Texas Cattle with ticks.
VI
North Carolina Cattle with ticks.
I
g
To test survival of infection of 1889.

FIG. 5.—Field inclosures for 1890 (scale ¼ inch=33 feet). For an explanation of the letters see Fig. 4.

Experiment 7 (to ascertain whether the infection of 1889 survived the winter).—For this purpose fields I and III of 1889 were thrown together by removing the intervening fences and the whole designated field I (see Fig. 5). The little stream was likewise fenced off in July to prevent any infection from field VI reaching it. A number of animals were pastured on this field.

May 26, 1890.—No. 74 (heifer, 2 years). Transferred to field II September 25.
May 26, 1890.—No. 91 (heifer, 3 years). Transferred to field VI October 1.
July 4, 1890.—(Stream fenced off, as field VI is now used for the first time.)
July 9, 1890.—No. 130 (cow, 5 years).
August 25, 1890.—No. 97 (bull, 1 year).

During the summer no ticks appeared in this field, so that it was evident that they had not survived the winter. No disease appeared in any of the animals exposed.

Experiment 8 (*to ascertain whether the disease introduced by Texas and that introduced by North Carolina cattle are the same*).—Four heifers were removed from their pasture near Houston, Tex., June 30, and sent by express to the station, where they arrived July 4. Hence, they were but four days off the Southern pasture before they were placed in field II (see Fig. 5). The heifers were in rather poor condition and all well supplied with cattle ticks of all stages. The field corresponded with field II, of 1889, but it was slightly enlarged so as to include about $\frac{2}{16}$ of an acre. The field thus contained—

(*a*) Texas cattle with ticks:

No. 124 (heifer, 2 years).
No. 125 (heifer, 3 years).
No. 126 (heifer, 4 years).
No. 127 (heifer, 5 years). All placed in field II, July 4.

(*b*) The native cattle were exposed in the following order:

July 4.—No. 128 (cow, 12 to 14 years). Dies September 1.
July 5.—No. 80 (cow, 7 years). Killed August 28.
July 5.—No. 82 (calf, 5 months). Diseased, but recovered.
July 5.—No. 167 (heifer, 1 year). Diseased, but recovered.
July 5.—No. 129 (heifer, 2 years). Dies August 29.
August 30.—No. 139 (cow, 6 years). Dead September 13.
September 25.—No. 74 (heifer from field I). Dies October 16.
September 25.—No. 62 (N. C. heifer of 1889). Exposure negative.

As regards the cattle ticks, the following observations were made: On July 30, only a few adults were still attached to the Texas cattle, the rest having disappeared. On October 20, only very few young ticks were still found on the surviving cattle, and eight days later they had all disappeared.

Any differences between the disease in this and the North Carolina fields could not be found.

Experiment 9 (*exposure to North Carolina cattle with ticks. General control field for 1890*).—Field VI was chosen for this purpose. It covers $1\frac{1}{8}$ acres, and is fenced off from the stream. Between it and the other fields (I, IV) is a strip of land containing the stream bed. To carry on the various experiments of the year, and to infect this field, cattle were taken from North Carolina fields as in 1889. The cattle were collected July 1, shipped by steamer from New Berne, N. C., July 2, and received at the station July 4. Of those received, the following were placed in field VI on July 4.

No. 114 (heifer, 2 years), from North Carolina; farm 1.
No. 112 (old cow), from North Carolina; farm 4.
No. 120 (cow, 7 years), from North Carolina; farm 2.
No. 119 (calf of No. 120, 3 months), from North Carolina; farm 4.
No. 121 (cow, 3 years), from North Carolina; farm 4.
No. 122 (heifer, 2 years), from North Carolina; farm 3.

These Southern animals were in fair condition, excepting No. 112, which was very thin and weak. All excepting No. 114 were well supplied with cattle ticks.

The following Northern animals were placed in field VI:

July 4.—No. 49 (cow, 4 years), exposed in 1889, but probably not affected at that time.
July 4.—No. 85 (calf of No. 49, 3 months).
July 4.—No. 50 (cow, 4 years), in field IV in 1889, but not affected.
July 4.—No. 57 (cow, 10 years), exposed in field I in 1889, but probably not affected.
July 4.—No. 79 (calf of No. 50, 3 months).
July 4.—No. 66 (heifer, 2 years), exposed in field IV in 1889, but not affected.
July 4.—No. 69 (cow, 3 years).
July 4.—No. 100 (calf of No. 69, 2 months).
July 4.—No 95 (cow, 4 years).
July 4.—No. 93 (calf of No. 95, 1½ months).
August 13.—No. 71 (heifer, 4½ years), transferred from field I.
August 13.—No. 134 (heifer, 2 years).
August 25.—No. 90 (bull, 1 year).
September 8.—No. 56 (steer, 3½ years), exposed in field II in September, 1889, but probably not affected.

These various animals (excepting Nos. 49, 56, and 57) may be regarded as unexposed natives, although some of them had been used the year previous and early in this season in fields presumably free from infection. The result of the exposure may be tabulated as follows:

No. 49 has a severe attack but recovers.
No. 85 has a mild attack.
No. 50 dies September 6, sixty-four days after the beginning of the exposure.
No. 57 is not affected.
No. 79 has a very mild attack and recovers.
No. 66 dead September 1, fifty-nine days after the beginning of the exposure.
No. 69 dies September 3, sixty-one days after the beginning of the exposure.
No. 100 has a mild attack, but succumbs in December.
No. 95 killed in dying condition, August 25, fifty-two days after exposure.
No. 93 has a mild attack.
No. 71 dead September 6, twenty-four days after beginning of exposure.
No. 134 killed in dying condition August 28, fifteen days after exposure.
No. 90 dies September 16, twenty-two days after exposure.
No. 56 has a prolonged but mild attack and recovers.

It will be seen from this table that all animals exposed in midsummer (July and August) died or were killed in a dying condition, excepting the calves. These were all affected; one died late in the fall and one was killed, but in every case the attack was mild. The mortality among those over 1 year old was 80 per cent. It will be noticed also that animals exposed in August died with those exposed a month earlier. Those exposed on July 4, when the field was first infected, died from fifty-two to sixty-four days thereafter. Those exposed in August died in fifteen to twenty-four days after the first day of exposure.*

On July 30 only a few full-grown ticks were left on the Southern stock. August 13, two weeks later, young ticks had appeared on all the cattle, native and Southern alike. August 25 some of these had become full grown. In the middle of October only a few young ticks could be seen, and by the end of the month they had practically disappeared.

Experiment 10 (exposure to cattle ticks only.)—Field VIII was used in this experiment. (See Fig. 6.) It is a fenced off portion of a piece of ground situated about one-fourth mile north of the station grounds upon which the experiments thus far recorded were carried on. This particular field covers about 1⅜ acres, and is separated from the adjoining fields VII and IX by strips of ground as shown in the plat. The ground is covered largely with trees (oak and chestnut) and may be regarded as sparsely wooded. It slopes toward field VII at an angle of 20°–30°. On July 4 about 4,000 matured and 1,000 half-grown ticks were scattered over the ground in this inclosure. The ticks had been collected between June 28 and July 2, about New Berne, N. C., and placed in a large can containing grass from the Washington station. At the time they were scattered over the field many had already laid a portion of their eggs.

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* In this field there were placed during the summer some animals which had passed through one attack of the disease, and some Southern animals kept on the station from the year previous. These cases will be reviewed under another subject.

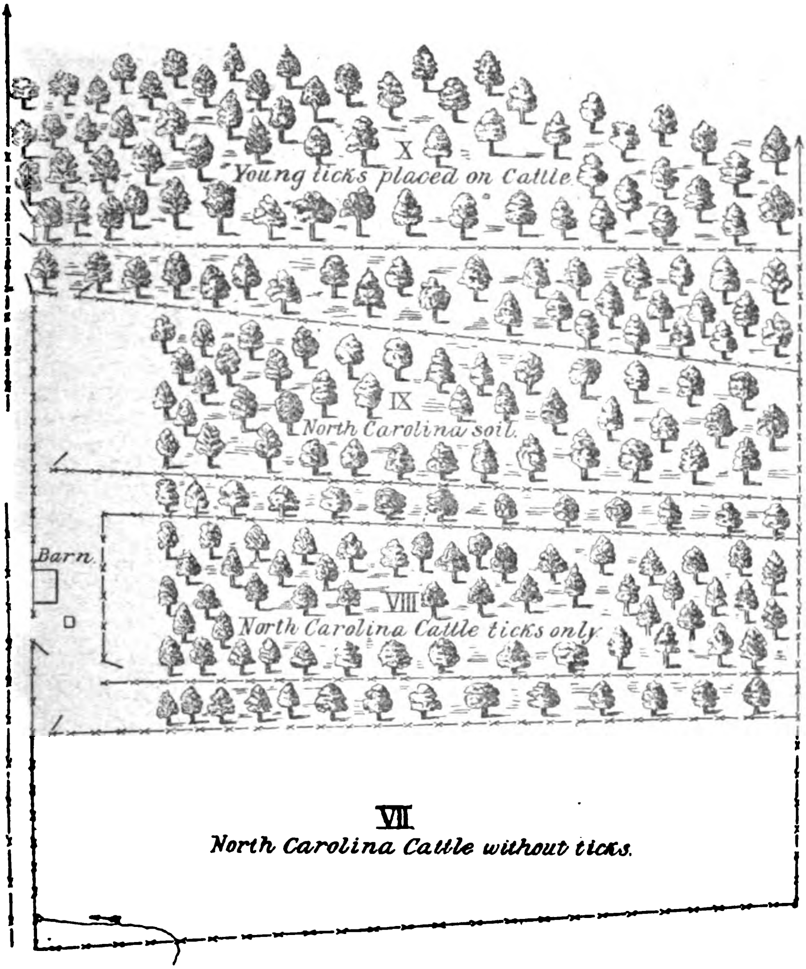
X
Young ticks placed on Cattle
IX
North Carolina soil.
Barn
VIII
North Carolina Cattle ticks only
VII
North Carolina Cattle without ticks.

FIG. 6.—Supplementary inclosures for 1890 (scale ½ inch = 33 feet).

In this field were placed the following native cattle:

July 4.—No. 76 (heifer, 1 year).

July 4.—No. 102 (cow, 6 years). No. 102_a (calf of No. 102, born on this field September 1).

July 4.—No. 105 (heifer, 2 years).

August 21.—No. 47 (cow, 4½ years, recovered case of 1889).

August 21.—No. 135 (heifer, 2 years).

The result of the exposure is briefly as follows:

No. 76 killed in dying condition August 18.
No. 102 very sick with Texas fever, but recovered.
No. 102_a died of Texas fever thirteen days after birth.
No. 105* very sick, but recovered.
No. 47* died September 12.
No. 135* very sick, but recovered.

Of the six cases exposed to the ticks only, all were unmistakably affected with Texas fever, as the notes recorded show. Three died and the autopsy confirmed the diagnosis. The reason why the mortality was not so high here as in the preceding experiment is probably to be sought for in the fact that under natural conditions the young ticks appear more successively, and cause a more prolonged infection, while in this experiment they probably appeared nearly all at the same time.

The young ticks were seen in this field August 8, and on August 23 full-grown specimens were found on No. 102.

Experiment 11 (*exposure to Southern cattle without ticks*).—This experiment was conducted on field VII, adjoining the field of the preceding experiment. (See Fig. 6.) It covers about 1¾ acres, and contains both running and standing water from a spring. It is not wooded. The following Southern cattle brought from North Carolina (with those placed in field VI of this year) were put into this inclosure after all ticks that could be found were carefully removed:

July 4.—No. 115 (cow, 6 years) from farm 4.
July 4.—No. 116 (heifer, 2 years) from farm 2.
July 4 —No. 117 (heifer, 2 years) from farm 3.
July 4.—No. 118 (cow, 10 years) from farm 4.
July 4.—No. 123 (heifer, 3 years) from farm 1.

Into this inclosure were placed on the same day the following native cattle: No. 103 (heifer, 3 years); No. 106 (heifer, 2 years); No. 108 (heifer, 2 years).

The Southern cattle were reëxamined three times a week between July 7 and July 28, to remove any ticks which on account of their small size had escaped detection. On a final examination July 30 no more could be found.

Nevertheless, on August 15, a few young ticks were found on the natives, and three days later a large number had attached themselves. The outcome was the death of the three natives. No. 103 died August 28; No. 106 died September 6; No. 108 died September 9.

The experiment had thus failed in so far as ticks had not been kept out of the field. Although it is not to be denied that some may have escaped attention and fallen to the ground, yet it is highly probable that most if not all the ticks or their eggs were washed in from the adjoining field VIII, which is considerably higher and slopes toward VII. There had been exceptionally heavy showers August 1 and August 8, which had carried much soil, and even stones as large as a fist, into this field. At all events, this difficulty might have been avoided by reversing the location of the two experiments and placing the animals free from ticks on the higher ground.

Experiment 12 (*production of Texas fever by placing on native cattle young ticks artificially hatched in the laboratory*).—Hitherto we had supposed that the cattle tick acts as a carrier of the disease between the Southern cattle and the soil of the Northern pastures. It was believed that the tick obtained the parasite from the blood of its host, and in its dissolution on the pasture a certain resistant spore form was set free, which produced the disease when taken in with the food. The feeding of one animal (No. 145) for some time with grass from field VI, the most abundantly infected of all, without any appearance of disease made this hypothesis untenable. But even before this feeding experiment was undertaken other facts were noticed which militated against this hypothesis, and which proved that the young tick calls forth the disease. In the first place, animals exposed when the field was first infected did not die until fifty to sixty days after the beginning of the exposure, while those exposed thirty or more days later on the same ground died in fifteen to twenty-five days thereafter. In the second place, all animals which succumbed had young ticks on them. In other words, the appearance of the disease was in some manner associated with the appearance of the new generation of ticks. Even with this fact fairly well determined, the true explanation that the young ticks were directly responsible for the disease seemed too far-fetched to deserve attention until it was demonstrated in the following manner. A yearling heifer had been placed in a box stall and a number of young ticks, hatched artificially in glass dishes, had been placed on this animal at intervals, beginning August 14, in order to determine whether ticks in the capacity of blood-sucking parasites made any impression on the number of blood corpuscles. It was found by a periodical estimation of the number of red corpuscles that after a certain time this number fell so quickly and so markedly as to be wholly incommensurate with the small amount of blood abstracted by the ticks. At the same time other symptoms of Texas fever appeared and the parasite was detected in the blood.

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* These cases were transferred subsequently to an uninfected field in order to determine whether they could communicate the disease to other natives.

The experiment was repeated on several other animals as soon as young ticks could be obtained.

No. 140 (heifer, 2 years old) kept in a box stall on a neighboring farm. The young ticks 3 to 4 days old were placed on it September 9. It was found dead October 2. Both blood examination during life and the autopsy demonstrated Texas fever.

No. 137 (heifer, 1 year old) was placed in field X, a wooded lot to which no infected cattle had been admitted, and on September 9 young ticks were placed on it. It passed through a severe attack of Texas fever and was killed in a dying condition November 6.

No. 144 (cow, 8 years old) was also kept in field X. The young ticks were placed on it September 17 and it was found dead October 3. In this case also the nature of the disease was beyond question.

Experiment 13 (production of Texas fever in the winter season by placing young ticks on cattle kept in an artificially heated stable).—The result of experiment 12 was so important that it was deemed best to repeat it in an artificially heated stable, as the season was too far advanced for ticks to thrive in the open air. The stable was warmed by means of a coal stove. The temperature fluctuated between 65° and 80° F.

The following animals were exposed and infected with young ticks:

No.	Age, etc.	Placed in stable.	Infection with ticks.	Number of infections.	Result.
143	Heifer, 1½ years	Oct. 27, 1890	Oct. 28–Nov. 8	2 (200-300 each time)	Slight if any effect.
145	....do	....do	Nov. 21–Dec. 3	7 (200–300 each time)	Prolonged case of Texas fever. Recovered Mar. 18, 1892.
149	....do	....do	Oct. 28–Nov. 21	6 (15 each time)	Slight, if any effect.
117[1]	Southern heifer, 2 years.	Nov. 19, 1890	Nov. 21–Dec. 3	7 (200–300 each time)	Do.
130	Cow, 2 years	Dec. 12, 1890	Dec. 13–Dec. 29	9 (200–300 each time)	Marked case of Texas fever. Recovered Feb. 18, 1891.
152	Cow, 4½ years	....do	....do	9 (200–300 each time)	Mild case of Texas fever. Recovered Jan. 20, 1891.

[1] In stall with No. 145.

The young ticks placed on Nos. 117, 143, 145, and 149 were descended from adults picked from diseased natives (Nos. 137, 138, and 140). Those placed on Nos. 130 and 152 were descended from adults received directly from North Carolina.

This experiment demonstrates that Texas fever may be produced at any season of the year if the conditions are fairly favorable; if, in other words, the temperature of the air is sufficiently elevated to permit the cattle tick to carry on its parasitic existence. Of five presumably susceptible animals infected with ticks three showed well-marked symptoms of Texas fever, and the remaining two reacted with a high temperature for a few days. In these latter cases there may have been a reduction in the number of red corpuscles also, but we can not regard such reduction demonstrated until the number falls below 5,000,000.

In these cases the high temperature appeared generally in fifteen days after the first lot of young ticks had been put on the animal. In No. 145 the period of marked destruction of red corpuscles was associated with high fever.

This experiment does not definitely prove that the progeny of ticks collected from susceptible Northern animals which have passed through the disease may produce as severe an attack as those descended from ticks picked directly from Southern animals. The positive result in No. 145, infected with "Northern" ticks, is vitiated by the fact that this animal was in the same stall with a Southern cow, No. 117. The severe secondary attack appeared in No. 145 in the middle of January. This would allow time for the ticks to mature on No. 117, and the next generation to attack No. 145. Hence No. 145 may actually have received the severe secondary infection from "Southern" ticks, in so far as they were descended from those matured on No. 117. This interpretation may be wrong and the secondary infection in No. 145 may have been a true relapse resulting from the primary infection with "Northern" ticks. The experiment as it stands, however, can only be interpreted as showing that ticks produce well-marked disease in artificially-heated stables in winter, and the other question, whether "Northern" ticks may do this, must be left open.

SUMMARY OF THE EXPERIMENTS OF 1890.

The discovery of 1889 that ticks alone are sufficient to infect a field was confirmed this year. The experiment designed to test the theory that Southern cattle are infectious only through the ticks they carry failed this year, for the field became infected with ticks after all.

Lastly, the demonstration of the important fact that the infection is conveyed by the young tick, and is probably introduced by it into the blood, was a very great stride in advance in our understanding of the external characters of the infection.

In field IX (see Fig. 6) several natives were exposed to North Carolina soil without becoming diseased.

On the station grounds field V (see Fig. 5) was infected with the blood and spleen pulp of cattle which had succumbed to Texas fever. The exposed natives did not become infected.

In field IV (see Fig. 5) during this same year a number of sick natives were brought together and some healthy natives added. The latter had a mild attack late in the season, only detected by the microscopic examination of the blood.

These three experiments will be fully discussed farther on, and we simply refer to them here to show that the animals not exposed under certain conditions did not become infected, although pastured not far from Texas-fever cases during the summer.

EXPERIMENTS OF 1891.

The arrangement of the fields for this year and the uses to which they were put are indicated on the accompanying plat. A tract of land adjoining the station grounds on the north was added to the territory in use. On this tract were situated a dwelling house and a number of unused sheds. For the purpose of carrying on the various experiments, cattle were collected near New Berne, N. C., as in previous years, and shipped by steamer from New Berne, June 30. They arrived at the station July 2, having been but two days on the way.

Experiment 14 (exposure to North Carolina cattle with ticks).—The general control experiment of producing the disease in the natural way was conducted, as before, by exposing natives to Southern animals on the same field. For this purpose inclosure VI was again selected (see Fig. 7). In this experiment not only unexposed natives but also recovered natives were reëxposed to test any acquired immunity. Similarly Southern animals, kept for one or two years on the station, were reëxposed to determine any loss of immunity. These collateral experiments will be discussed in dealing with these subjects. In this place we simply summarize the results of the exposure of fresh natives.

The animals placed in this field comprised the following:

(*a*) North Carolina cattle:*

July 2.—No. 172 (cow, 6 years), from farm No. 6.
July 2.—No. 174 (cow, 3 years), from farm No. 5.
July 2.—No. 177 (cow, 5 years), from farm No. 3.
July 2.—No. 178 (cow, 4 years), from farm No. 2.

(*b*) Natives.

July 2.—No. 104 (cow, 4 years). Very sick; recovered.
July 2.—No. 159 (heifer, 2 years). Not very sick; recovered.
July 2.—No. 163 (cow, 6 years). Very sick; killed August 25.
September 1.—No. 169 (cow, 8 years). Died September 14.
September 1.—No. 181 (cow, 2½ years). Killed in dying condition September 19.
September 15.—No. 184 (heifer, 2 years). Died October 2.
September 21.—No. 160 (cow, 2½ years). Prolonged attack; recovered.
September 21.—No. 187 (calf of No. 160, 4 months). Not affected.

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* Eight animals were brought North, two from each farm, and divided equally between this and the following experiment.

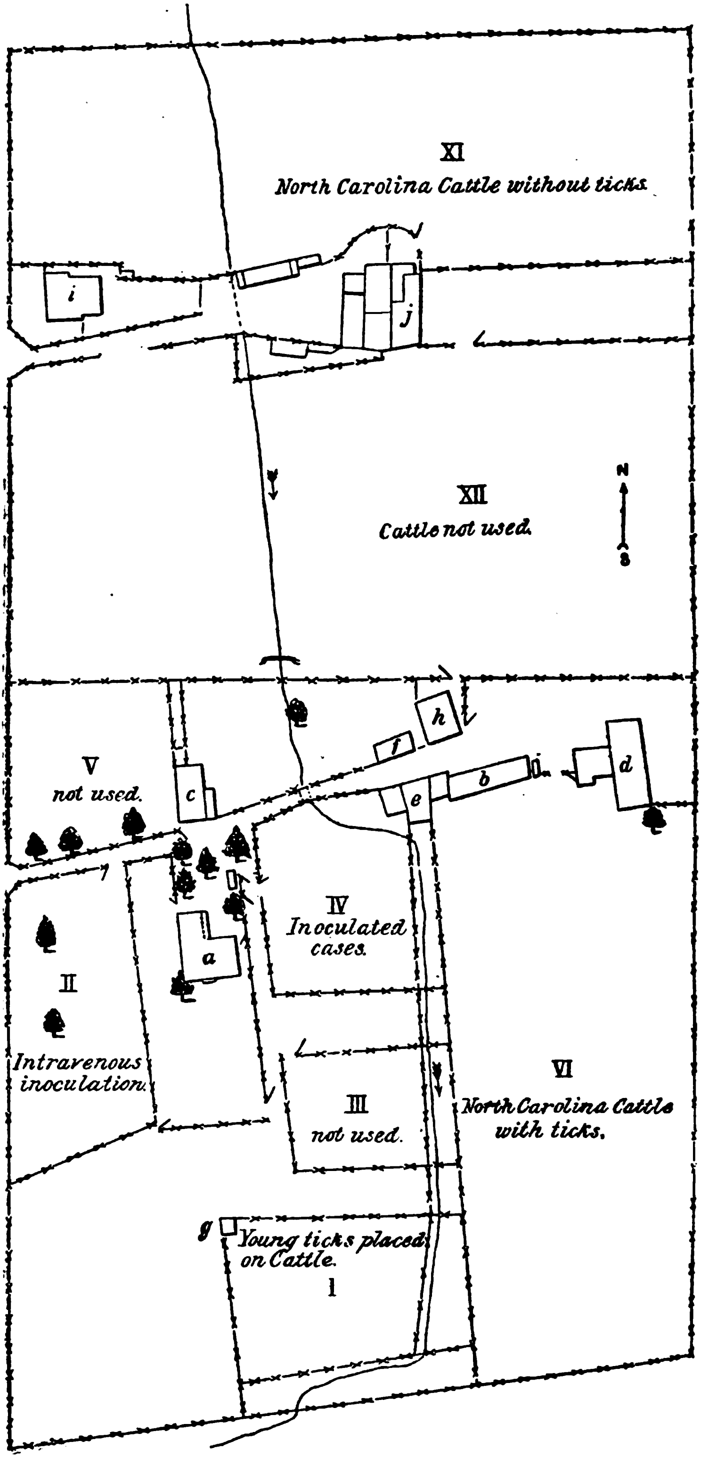

FIG. 7.—Field inclosures for 1891 (scale ¼ inch = 36½ feet). *a* to *g*, as in Fig. 4; *h*, swine pen; *i*, dwelling house; *j*, cow stalls.

All animals excepting the calf were attacked by Texas fever. No. 163 was killed at the height of the fever and probably would have died. The mortality among these animals was lower than in the preceding year, the conditions being precisely the same. Among those exposed later on, the mortality was higher than among those exposed early. The ticks in this field had entirely disappeared from the Southern stock by the end of July. The young ticks had appeared in considerable numbers on all the cattle August 10, and continued to increase in number during August on all cattle alike. They had all disappeared by the last of October.

Experiment 15 (*exposure to North Carolina cattle without ticks*).—The great importance of determining whether or not the ticks are the only carriers of the infection from the permanently infected regions of the South imposed upon us the necessity of trying this experiment until it could be stated with certainty that no ticks had passed from Southern to native cattle. The experiment of 1890 (Exp. 11) had failed because young ticks had appeared on the natives in course of the summer. For the repetition of this experiment the hitherto unused inclosure XI (see Fig. 7), covering over 2 acres, was chosen. The following North Carolina cattle were put into it July 2, after the ticks had been carefully picked off: No. 173 (cow, 3 years), from farm 6; No. 175 (cow, 4 years), from farm 5; No. 176 (cow, 6 years), from farm 3; No. 179 (cow, 5 years), from farm 2.

The following natives were added at the same time: No. 161 (cow, 6 years); No. 164 (cow, 7 years); No. 167 (heifer, 3 years).

The Southern animals were reëxamined daily and a few small ticks found each day until July 22. Thereafter very few were found, and after July 29 none. Nevertheless, a few adults must have escaped and dropped on the ground, for young ticks made their appearance, though in small numbers, in August. From August 22 to September 3 several hundred were removed from the three natives. No. 164 was most abundantly infected. Next came 167 in this respect. No. 164 suffered a severe attack and was found dead September 3. No. 167 likewise passed through a severe attack, but recovered, while in No. 161 signs of infection were not detected, as will be seen by an examination of the notes in the appendix. The severity of the disease was thus in general proportional to the number of ticks found on these animals.

Experiment 16 (*production of disease with young ticks hatched artificially*).—This is a repetition of experiments 12 and 13 of last year, but is made much earlier in the summer. A large number of adult ticks were collected June 25–27 from cattle near New Berne, N. C. An abundance of eggs had been laid by July 7, which were placed in glass dishes containing a few fresh leaves and a few drops of water and covered snugly with a piece of glass. The young ticks began to appear July 23.

July 25, Nos. 166 and 180, both 2-year old heifers, were placed in field 1 (see Fig. 7). To the rump and neck young ticks were applied daily for ten days until August 4. No. 166 received from 200 to 300 daily, No. 180 only 20 to 30 daily. After each application the heifers were held quiet for a few minutes until the young ticks had crawled away through the hairs.

July 29, No. 158, a 2-year old steer, was placed on the same field and several thousand ticks from the same lot applied at one time.

August 20, No. 117, a North Carolina heifer of 1890, was placed in the same inclosure and several thousand ticks of the same lot applied at one time.

The following table summarizes the experiment:

No.	Age, etc.	Young ticks applied.	Number of application.	Result of exposure.
166	Native heifer, 2 years	July 25–Aug. 4	10 (200–300 each time)	Severe attack; recovered.
180	....do	....do	10 (20–30 each time)	Severe attack; died Aug. 12.
158	Native steer, 2 years	July 29	1 (several thousand)	Severe attack; recovered.
117	Southern heifer	August 30	1 (several thousand)	No result.

In all natives a marked case of Texas fever was produced, which proved fatal in that animal to which the smallest number of young ticks had been applied. It is also interesting to note that in this experiment Texas fever appeared much earlier than in field VI (experiment 14), when the infection took its natural course. Thus in the latter field the disease was first observed August 18, while among the artificially infected it appeared as early as August 7.

EXPERIMENTS OF 1892.

The field work of this year was mainly directed toward determining whether or not Texas fever is transmitted without ticks. The experiments of the two preceding years had failed, because young ticks appeared on the native cattle, though they had been very carefully removed from the Southern animals. This year the experiment was tried over again, and with entire success. The young ticks did not appear on the native cattle, and the latter remained free from disease in spite of the presence of North Carolina cattle. Another very important fact was demonstrated. Texas fever was produced in natives by the intravenous injection of blood from healthy North Carolina cattle, and natives exposed to these sick natives did not contract the disease, because ticks were absent.

The Southern animals used in the field work of the summer were six in number, gathered together from two farms near New Berne, N. C., three being taken from each farm. They left New Berne by steamer June 29, and reached the station July 1, being off their native fields about four days before they were placed in the fields at the station.

The field inclosures for this year are numbered as they were last year. Hence the plat of 1891 (Fig. 7) will serve to illustrate the experiments to be described.

Experiment 17 (*exposure to North Carolina cattle with ticks*).—This experiment was to serve as a control upon the following experiments. Field VI was again used for this purpose. Two Southern animals, one from each North Carolina farm, were introduced as sources of the infection. The contents of the field and the general results of the exposure may be tabulated as follows:

June 30, 1892.—No 201 (cow, 5 years). Removed to uninfected field July 20; not diseased.
June 30, 1892.—No. 203 (cow, 6 years). Died of Texas fever August 22.
July 1, 1892.—No. 216 (North Carolina cow, 6 years).
July 1, 1892.—No. 217 (North Carolina cow, 6 years).
July 20, 1892.—No. 220 (steer, 2½ years). Very sick; recovered.
July 20, 1892.—No. 223 (heifer, 6 years). Died of Texas fever August 23.
August 26, 1892.—No. 204 (bull, 2½ years). Very sick; recovered.

On July 20 only a few half-grown ticks were found on the Southern cows. On August 5 the young ticks were first noticed on the natives;

at this time they had probably been on the cattle only two or three days. The outcome of the exposure does not differ from that of preceding summers. All exposed animals contracted Texas fever, and two of the three early exposures died.

It is interesting to note that No. 201, though it was pastured on the infected field for twenty days, remained perfectly healthy, because it was removed to an unused field (IV) *before the young ticks had appeared in the infected field.* It is likewise worthy of notice that No. 223, though exposed twenty days later than No. 203, became infected at about the same time and died only a single day later. The reason for this has already been pointed out, but it deserves repetition. The infection of the field is established when the young ticks have hatched, and not before. Hence a field is not dangerous until twenty or twenty-five days (according to the average temperature) after Southern cattle have pastured on it.

Experiment 18 (*exposure to North Carolina cattle without ticks*).—Field I (see Fig. 7) was used for this test. Two North Carolina cows (Nos. 212 and 213), one from each farm, were chosen, so as to make the conditions as nearly like those in the control field as possible, and the ticks carefully picked off before they were placed in this field. They were subsequently examined daily for any ticks too small to be seen originally. Two native cows (Nos. 208 and 209) were placed in the inclosure with them. These remained perfectly well throughout the summer.

Experiment 19 (*exposure to North Carolina cattle without ticks*).—This is an exact duplicate of the preceding experiment, to insure the success of one in case the other failed, by reason of the appearance of young ticks. Two North Carolina animals (Nos. 214 and 215), one from each farm, were carefully picked over and all ticks removed so far as they could be detected. They were placed in field No. II, July 2. Two native cows (Nos. 205 and 210) had been placed in the same field two days before. The Southern animals were carefully reëxamined for ticks, as in the experiment preceding, for several weeks. In this field no disease appeared during the entire summer.

The cases in these fields may be tabulated as follows:

Field I.

July 2.—No. 212 (North Carolina cow, 3 years).
July 2.—No. 213 (North Carolina cow, 5 years).
June 30.—No. 208 (cow, 5 years). Exposure negative (October 1).
June 30.—No. 209 (cow, 9 years). Exposure negative (October 1).

Field II.

July 2.—No. 214 (North Carolina cow, 4 years).
July 2.—No. 215 (North Carolina cow, 4 years).
June 30.—No. 205 (cow, 5 years). Exposure negative (October 1).
June 30.—No. 210 (heifer, 2 years). Exposure negative (October 1).

MISCELLANEOUS EXPERIMENTS.

Experiment 20 (*to test infection by way of the digestive tract*).—No. 131, a heifer, 2 years old, was placed in a box stall July 29, 1890, and fed at three intervals about 2,000 adult live ticks in all. The animal remained well. No blood examinations were made.

No. 110, a heifer, 1 year old, was placed in a box stall August 14, 1890, and fed several thousand young ticks and egg cases. The result was to all appearances negative. Unfortunately the blood was not examined.

No. 145, a heifer, 18 months old, was placed in a box stall September 17, 1890, and fed once daily with one-fourth bushel of grass cut from the infected field VI, together with hay and mill feed. The experiment was closed October 12. No indications of disease during the feeding or until November 21, when it was used in another experiment.

Experiment 21 (*to test presence of infection in young ticks*).—August 29, 1891, a large number of young ticks nearly 1½ months old, and still confined in the glass dish in which they were hatched, were crushed in a mortar in sterile distilled water. The turbid brownish liquid was filtered through two thicknesses of filter paper. A portion of this filtrate was passed through a Pasteur filter to remove organisms of every kind.

No. 165 (heifer, 2½ years) received into the right jugular vein 10 cubic centimeters of the fluid passed through the Pasteur filter.

No. 183 (heifer, 2½ years) received into the right jugular vein 5 cubic centimeters of the turbid fluid not passed through a Pasteur filter. Repeated examination of the blood in both cases failed to show any disease.

In 1892 a similar experiment was tried with equally negative outcome. Nos. 202 and 207 were used for this purpose, and their history, together with the blood examinations, may be found in the appendix.

The result of these two experiments is at present inexplicable. The crushed ticks introduced into the blood fail to produce any infection whatever, while ticks from the same lots when placed on the skin (see No. 224) produce Texas fever. The experiment simply demonstrates our incomplete knowledge of the life history of this parasite.

GENERAL SUMMARY OF THE FIELD EXPERIMENTS RELATING TO THE CATTLE TICK.

We are now in a position to review the results of the field work of the past four summers and determine how far they enable us to draw definite conclusions. In addition to the general control experiments (Experiments No. 1, 3, 4, 8, 9, 14, and 17) by which Texas fever was produced in the natural way in natives which pastured on the same ground with Southern (North Carolina and Texas) cattle, experiments have been carried on in the three directions outlined on p. 92.

(1) Experiments with Southern cattle from which the ticks were picked off were made every year. (Experiments No. 2, 5, 11, 15, 18, and 19.) Those made in 1889 and 1892 were successful. Those made in 1890 and 1891 failed because young ticks appeared subsequently. The conclusion from these experiments that the tick is necessary to cause infection in Northern cattle may be regarded as demonstrated.

(2) Experiments to show that fields may be infected by cattle ticks alone were made in 1889 and 1890. (Experiments No. 6, 10.) In both Texas fever was produced.

(3) Experiments to show that young ticks artificially hatched produce Texas fever when placed on susceptible cattle were made in 1890, 1891, and 1892. (Experiments No. 12, 13, 16.) These were uniformly successful in the summer and fall months.

It was observed, however, that the disease induced by such ticks is less fatal than that produced in the fields in the natural way. We are not prepared to account for this difference, unless it be the mode of incubation. The artificial condition of heat and moisture under which the eggs are kept may lead to a speedy destruction of the microparasites which are in some unknown way associated with them.

THE RELATION OF THE CATTLE TICK TO THE "PERIOD OF INCUBATION" OF TEXAS FEVER AND TO THE INFECTIOUSNESS OF SOUTHERN CATTLE.

In the foregoing experiment everything points to the cattle tick as the natural transmitter of the disease. It has been definitely demonstrated by our experiments that not only fields may be infected by simply scattering matured ticks over them, but that cattle themselves may be infected in stables away from all infected ground by placing on them young ticks artificially hatched.

We are now in a position to understand the peculiar variability in the period of incubation. We have seen from the experiments related that when native cattle are exposed to Southern cattle on a given field the period elapsing before the disease appears is generally over forty-five days, and the first deaths usually occur one or two weeks later, as is illustrated by the following table:

Year.	Experiment.	Date of exposure.	First high morning temperature.	First death.	Number of days after exposure.
1889	1	June 27	Aug. 15	Aug. 23	57
1890	9	July 4	Aug. 18	Aug. 27	54
1890	8	July 4 and 5	Aug. 23	Aug. 29	55
1891	14	July 2	Aug. 18	Aug. 29	58
1892	17	July 1	Aug. 16[1]	Aug. 22	52

[1] There was a period of high evening temperature in this field July 20–25, the significance of which is not clear.

This long period coincides with the time necessary to produce a new generation of ticks. When Southern cattle graze on a certain pasture in early summer, say for a day only, a few ripe ticks drop off. They lay their eggs in about seven days. These are hatched in about twenty days, and are at once ready to crawl on cattle. Ten days thereafter the first high temperature usually appears. If we add these figures together we find that the disease may appear about thirty-seven days after the field was infected.* To be sure, these figures are liable to fluctuations which may make this period much longer, or perhaps a little shorter at times.

When Southern cattle are placed on a certain field and kept there, as in our experiments, the field becomes much more abundantly infected with ticks, for the reason that all the ticks in their various stages ripen and fall on the same ground. Hence there is a continuous infection of the field going on for several weeks, until all the ticks originally attached to the Southern cattle have disappeared. This may increase the severity of the disease.

But how may we account for the fact that cattle placed on infected pastures later may become diseased at the same time, and may die in less than fifteen days after the first day of exposure? Simply by taking into account the fact that cattle exposed late are at once attacked by the young ticks already present on the field. Hence, if we allow ten days for the fever to appear after the ticks have crawled on the cattle the mystery is at once explained.

The explanation of unusually prolonged periods of incubation is equally simple. They are associated with very early importations of cattle, and the low temperature retards the development of the young in the egg. We have already shown that this development may be greatly retarded by cold, and we have observed periods of incubation ranging from twenty to forty-five days, and have kept eggs over winter which developed when the temperature became warm enough the following spring.

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* In 1890 the Texas-fever parasite was first detected thirty-four days after the first day of field infection.

Billings has compiled a table (8, p. 47) embracing ten outbreaks of Texas fever which have occurred in various Western States since 1868. The period elapsing from the date of exposure to that of the first death ranges from thirty-three to ninety days. Leaving out of account these two extreme periods, the remaining ones range between forty-six and sixty-five days. The short period of thirty-three days is probably due to the fact that the native cattle were exposed on a field which had been infected some time before, and on which the tick eggs had consequently undergone more or less development. This is made highly probable by putting this outbreak with the one after it in the table.

(6) Tolono, Ill., June 25, 1868 (date of arrival of Texans).....July 28 (first death). Period 33 days.

(7) Sodorus, Ill., June 1, 1868 (date of arrival of Texans)....July 28 (first death). Period fifty-six days.

Tolono and Sodorus are on the same railroad and but 5 miles apart. The Sodorus fields were infected June 1, and the period of incubation is fifty-six days, the usual time. The Tolono fields were most likely infected at the same time, since the first death occurred at both places on the same day. That they were not also infected twenty-five days later we do not pretend to gainsay. At this time of the year, *i. e.*, June and July, the period of thirty-three days is somewhat short for the appearance of a new generation of ticks, and the explanation given will clear up this difficulty. Billings has furnished a very good illustration (8, p. 47) of the prolongation of the period between infection of pastures and the appearance of the disease in an outbreak at Tekamah, Nebr., studied by him in 1887. The Texans infected the field as early as April 1, or thereabout, but the disease did not appear until ninety days thereafter.

There is general unanimity on this point, that a long period elapses between the date of infection of a given pasture and the appearance of the disease, so that further illustrations may be dispensed with. In searching over all the various publications on this subject we have not yet encountered any authentic statement which gave dates to support its claims that Texas fever ever appeared on a field within thirty days of the time that it was entered by tick-bearing cattle. If there are any such outbreaks they may have been produced either by ticks wintering over in the egg, or by an infection of the field earlier than that actually noted. It is not improbable that Southern animals may accidentally carry some eggs of ticks, nearly hatched, on their feet or other parts of their body. In such a case disease might appear several weeks earlier. The same would be true if ticks which have once attached themselves to cattle should, after being accidentally torn or brushed off, crawl upon natives, provided they are still infectious.

The relation of young ticks to Texas fever explains why natives placed in an infected inclosure at various intervals before the appearance of the young ticks will all contract the disease at the same time. They may mingle with *freshly arrived* Southern stock for twenty or twenty-five days before becoming infected. If removed at the end of this period *before* the appearance of young ticks they remain healthy. (See Expt. 17.) We now understand why natives placed on an infected field after the young ticks have appeared will contract Texas fever in ten to fifteen days. The life history of the tick likewise explains the frequently observed fact that Southern cattle lose the power of infecting Northern pastures after a certain number of days. We have already stated that the ticks on Southern cattle gradually disappear as they become matured. It is evident that when all have dropped off the power of the cattle to infect fields is lost. It is possible to give the exact period of time required, provided we know the time which has elapsed since Southern cattle left their pastures, where they are being continually infected with young ticks. On the station pastures the time required for all the ticks to disappear was twenty-five to thirty days. Very soon thereafter the young ticks, descended from the ticks which matured first, appeared on all cattle, and the Southern animals again became infectious. The maturation of the second generation may push the period of disease into the fall and thereby rob it of its fatality.

We now likewise understand how cattle driven slowly northward lose their infection after a time. As soon as they have left the territory where ticks abound they receive no more accessions of young ticks, and they are continually dropping mature ones. After twenty-five to thirty days, or perhaps sooner, they have parted with all and are henceforth harmless to Northern stock.

Let us now review briefly what occurs when Southern tick-bearing cattle are placed in the same inclosure with natives. If the animals be brought together early in July, as in our experiments, nothing unusual will be noticed for weeks. The ticks on the Southern animals slowly mature, swell up, and drop off, one by one, so that after three or four weeks all have practically disappeared. If, during the second week in August, the cattle be carefully examined, young ticks will be found attached to the skin and buried within the coat of hair. They may be overlooked if the examination is superficial and hasty. A week later, generally in the third week in August, the temperatures of all exposed native cattle suddenly rise to 105° or 107° F. within a few days of one another. The ticks at this time are still quite small, and have not yet passed through the second molt. Even at the post-mortem examination of many cases only small, immature ticks are found. If the natives survive the attack, the ticks mature, swell up, and drop off, ready to give birth to a second generation if the season permits.

THE RELATION OF THE CATTLE TICK TO THE MICROÖRGANISM OF TEXAS FEVER.

The hypothesis which seemed most plausible after the experiments of 1889 was that the tick, while withdrawing the blood from Southern cattle, drew out in it the Texas-fever parasite, which, entering into some more resistant state, perhaps some spore state, was disseminated over the pastures when the body of the mother tick became disintegrated. These spores were then supposed to enter the alimentary tract with the food and infect the body from this direction. The later experiments, however, completely demolished this conception. Neither the feeding of adult ticks and tick eggs nor the feeding of grass from infected pastures gave any positive results. On the other hand, the unmistakable outcome of the experiments was that the young tick introduced the infection into the body. This fact implies two possibilities. Either the tick is a necessary or a merely accidental bearer of the microparasite. If a necessary bearer of the infection, we must assume that the latter undergoes certain migrations and perhaps certain changes of state in the body of the adult tick and finally becomes lodged in the ovum. Subsequently it may become localized in certain glands of the young tick and discharge thence into the blood of cattle. This hypothesis assumes a complex symbiosis between the tick and the parasite on the one hand and the cattle and the tick on the other. According to another, simpler hypothesis the tick would be merely an accidental bearer of the infection. The parasite entering the body of the tick with the blood of cattle may be already in the spore state or about to enter upon such a state. The young ticks, as they are hatched near the dead body of the female, may become infected from this. This infection, clinging to their mouth parts, is introduced into the blood of the cattle to which they subsequently attach themselves. Further investigations are necessary before the probable truth of one or the other of these hypotheses can be predicated with any degree of certainty.

It should be stated that the contents of the bodies of ticks in various stages of growth have been examined miscroscopically with considerable care. The abundant particles resulting from the breaking up of the ingested blood corpuscles obscured the search so that nothing definite has thus far resulted from it. The very minute size of the micro-organism renders its identification well-nigh impossible, and any attempts will be fraught with great difficulties.

A question of much interest, but one upon which we have no information, is the relation of the cattle tick to the enzoötic Texas fever area. Is the distribution of the tick coextensive with that of the Texas fever microparasite, or does their distribution obey different laws? This question could be solved by a thorough investigation of a small portion of the border line of the enzoötic territory. This border line probably depends on the mean annual temperature, and hence we can not expect to find it very sharply defined. Ticks may extend farther north during some seasons than others, and hence there may be a belt or strip on which cattle are partially insusceptible because of former repeated attacks, although for the time being ticks may be absent. The entire subject is at present speculative, and is simply referred to here to arouse the attention of those who are in a position to record observations concerning it.

THE RELATION OF SOUTHERN CATTLE TO THE TEXAS-FEVER INFECTION.

What has already been said concerning the tick makes it certain that all Southern cattle are dangerous when they bear the cattle tick, whether they are sick or healthy. On the experiment station fields, the North Carolina and Texan cattle which called forth Texas fever during the four years of the investigation were, in general, healthy. Two cows were killed. One of these had impoverished blood, although positive signs of Texas fever were not detected. Another died of peritonitis. The remainder were healthy, improved on the pastures, and were sold at the beginning of winter or before.

In the foregoing pages it has been assumed that the tick obtains the microparasite from Southern cattle. Without demonstration it might be claimed with equal propriety that the microparasite belongs essentially to the cattle tick, and that its multiplication in the body of susceptible cattle is perhaps an accidental phenomenon against which Southern cattle have been amply protected by frequent infection. Experiments made latterly, as well as the microscopic examination of the blood, prove that the microparasite is harbored by Southern cattle in a state of health. These interesting experiments, as far as they have been carried up to the present, are briefly summarized here. The complete record of these cases will be found on page 298.

Inoculation with blood of healthy North Carolina cows soon after the latter had left the Southern pasture.—On July 6, 1892, a native cow, No. 198, received into a jugular vein 28 cc. of blood drawn from a jugular vein of a North Carolina cow, No. 217. The quantity of blood injected was large, because it was supposed that if the microörganisms were present at all in the Southern cattle, they would be very scarce. The blood was drawn from the Southern cow by piercing the wall of the vein with the needle of a previously sterilized and warmed hypodermic syringe, holding 14 cc., and injected immediately after into the exposed jugular of the native cow by simply piercing the wall of the vein. The entire operation lasted about two minutes. The high temperature became continuous on the seventh day after inoculation, and the number of red blood corpuscles had begun to fall on this same day. The various symptoms of Texas fever became gradually intensified, and the animal died July 19, thirteen days after inoculation. On the day before death the urine was claret-colored. The autopsy revealed the usual lesions of Texas fever.

On the same day No. 206, another native cow, was inoculated in the same way with blood drawn from a jugular vein of North Carolina cow, No. 216. The same quantity, 28 cc., was injected as before, 14 cc. being injected at a time. The high temperature and the destruction of red blood corpuscles set in at the same time with those of the preceding case. This animal did not die, however. After passing through a prolonged fever period the animal slowly recovered to suffer a relapse, which kept the number of red corpuscles below 2,000,000 during the whole of September.

On July 16, ten days after the preceding inoculations, a third cow, No. 219, received the same quantity of blood into a jugular vein. The blood was drawn from North Carolina cow No. 216. The continuous high temperature began July 24, at which date the destruction of corpuscles had set in. The further history of this case is very similar to that of the preceding, No. 206. The blood corpuscles continued to decrease in number until August 6. After this there was a slow rise. At the end of August a relapse was detected, which continued throughout September.

Inoculation with blood of healthy North Carolina cattle sometime after the latter had left the Southern pasture.—On August 15, a steer, No. 222, received 28 cc. of blood drawn from North Carolina cow No. 214. The same procedure as above was adopted. The disease had become established by August 25, as is shown by the high temperature and the marked reduction in the number of red corpuscles on this day. The movement of the disease was markedly slower so far as this latter phenomenon is concerned. In the middle of September a relapse was detected, which was still in progress at the beginning of the second week in October.

On September 9, a cow, No. 230, received the same quantity of blood from No. 214 into a jugular vein. In this case the first high temperature appeared September 14, and by October 1 the number of red corpuscles had fallen to 2,200,000.

These positive results demonstrate that the Texas fever microörganism was present in the blood of North Carolina cattle as long as seventy-four days after they had left the permanently infected territory. One cow, No. 217, was tested once on the ninth day; another, No. 216, was tested on the ninth and the twentieth day; a third was tested on the forty-ninth and the seventy-fourth day. That the microörganism was the one found in natives infected in the ordinary way on pastures was demonstrated in every one of the five cases by a large number of microscopic examinations. No difference whatever could be detected. Moreover, three out of the five inoculated cases passed through relapses or mild secondary attacks, in which the stage of the peripheral coccus-like body appeared constantly in the blood, as in the ordinary mild type of the disease. There can be no doubt, therefore, that the microparasite transmitted in the blood of Southern cattle was the same as the one introduced into the blood of natives by the cattle tick.

It might be claimed the Southern cattle harbored this microparasite because they are being constantly reinfected by the cattle tick. This might be true of Nos. 216 and 217, but it does not hold for No. 214. This animal was one of the four from which the ticks had been carefully picked in July, so that at the date of the last inoculation with blood from this animal it must have been entirely free from ticks for at least fifty days, and it had received no fresh accession of ticks since leaving its native pasture, June 27 (seventy-four days).

Whether the Texas fever parasite resides permanently in the bodies of Southern cattle or whether its presence, after all, depends on that of the cattle tick, these experiments do not permit us to decide definitely at present.* From an economic standpoint this is of little importance, since in many parts of the permanently infected territory of the South ticks are present during the entire year.

The presence of the parasite in Southern cattle does not seem to materially affect their health, although it may maintain a more or less constant breaking up of the red corpuscles on a small scale, which would necessarily tax certain vital organs. The parasite is present in the circulating blood in such small numbers, however, that only after a most tedious microscopic examination is it occasionally encountered. The fact that Southern cattle rid themselves of infectious properties on Northern pastures after twenty-five to thirty days does not, therefore, imply that their blood is no longer infectious. It simply signifies that they have rid themselves of the means by which this parasite is transmitted, namely, the cattle tick.

In the various Southern animals whose blood was examined at one time or another during these investigations, the number of red blood corpuscles was, in general, fully up to the level maintained by the natives used in the experiments. A few southern animals were kept on the station grounds for longer periods, and subsequently exposed to Texas fever infection fresh from the South. Of these, No. 117 exposed, in winter, five months after arrival from the South, Nos. 32, 62, and 59 exposed one year thereafter, and Nos. 55 and 60 two years thereafter, showed the normal number of red corpuscles.

The discussion which has raged so persistently about the health of Southern cattle has outlived its usefulness or suggestiveness, for it does not matter in what condition they are. So far as our evidence goes—and this is very strong—they are quite harmless, provided they do not carry the cattle tick. Hence there is no necessity for going into a review of the statements of Gamgee, the Metropolitan Board, and of F. S. Billings on this point. It is not claimed that Southern cattle may not and do not contract Texas fever. It is highly probable that every Southern calf has to go through the process of natural inoculation and reinoculation to a greater or less extent, and we have the records of several calves of Southern parents which passed through a mild form of the disease. It is likewise probable that a certain percentage of Southern animals which have not been sufficiently exposed while young may contract Texas fever in adult life under abnormal conditions. It is not impossible that under the influence of prolonged marches, crowding in cattle cars and on vessels, with insufficient air and food, the natural resistance of the body may break down and the mild or unobserved infection break out into an acute disease. These are possibilities as yet unproved, but they are by no means ignored when we state that Southern cattle, to all appearances healthy, do transmit Texas fever, and it is not necessary that they have any symptoms of disease, recognizable by clinical methods, to make them dangerous. We do not now wish to enter into philosophical discussion as to what constitutes disease. From a practical economic standpoint we must maintain that Southern cattle may be healthy and yet be the cause of Texas fever.

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* The production of disease in 1891, by ticks which wintered over on one of the fields of the station, would at first sight suggest the inference that the cattle tick carried the parasite through the winter in the egg. This does not follow from the circumstances, however, for there were in the same inclosure Southern cattle which had been kept over one or two years for purposes of reëxposure. Ticks hatched in spring may have invaded all the cattle in the inclosure, matured and dropped off, and given rise to another generation, which produced the disease late in August. This second generation may have obtained the microparasite from the Southern cattle.

The various hypotheses which observers have framed concerning the infectious character of the excreta of cattle, the saliva hypothesis of Detmers, the manure hypothesis of Billings, or the urine hypothesis of others must now be considered as unfounded so far as these excreta are claimed to be the direct source of the disease, since the excreta of Southern cattle on Northern fields can not produce Texas fever. In those experiments which demonstrate that Southern cattle may pasture with susceptible Northern cattle throughout the summer without imparting disease, provided all ticks be removed, we have all the necessary proof for refuting these hypotheses, since the excreta and secretions of all kinds are left on the field. The only object missing is the cattle tick.

SICK NATIVES AS SOURCES OF INFECTION WHEN THE CATTLE TICK IS PRESENT.

This matter has called forth much discussion by scientific observers as well as by cattle-owners. It is a question of considerable importance to determine whether cattle which have contracted Texas fever in the ordinary way may transmit it to other natives coming in contact with them. That such transmission must be very rare is evident, otherwise there would have been no discussion and no divergent opinions. It is certainly a very curious fact that animals, which are affected with an infectious disease contracted indirectly through the presence of certain presumably healthy cattle, should not also transmit the same disease to other susceptible cattle. Theoretically, there is nothing opposed to the view that sick natives may infect other natives, and we shall show that they actually do so; but the conditions under which this infection takes place are rarely realized, and hence very little disease due to natives comes under observation. The fact that the disease may be transmitted from sick to healthy natives directly by injections of blood into the veins does not help us in solving the problem before us, since the disease is not conveyed in this way. If we turn, however, to the life history of the tick we shall find the explanation sought.

Sick natives have ticks on them. But only those which survive the disease or die after a prolonged attack ripen the tick on their bodies. Those which die of an acute attack in a short time after infection have only immature ticks on them. If the fever has occurred early enough in the season to permit a second generation of ticks to appear before the cold weather arrives, we may expect Texas fever on fields on which sick natives only have pastured. Usually the first outbreak occurs in August, and the second, to be looked for in late September or early October, is so mild as to pass unobserved. If, however, the first outbreak occurs in July, the second may appear in September and perhaps be of greater virulence.

In order to test this problem the following experiment was carried out: In 1890 Field IV (see Fig. 5, p. 248) was set aside to be infected with sick natives only. The following sick animals were introduced:

August 21.—No. 49 and calf No. 85, exposed in Field VI since July 4; elevated temperature since August 19.

August 21.—No. 105, exposed in Field VIII (ticks only) July 4; elevated temperature since August 13.

September 3.—No. 50, exposed in Field VI July 4; elevated temperature since August 27.

September 5.—No. 47, exposed in Field VIII (ticks only) August 21; elevated temperature since September 1.

September 8.—No. 135, exposed in Field VIII (ticks only) August 21; elevated temperature since August 30.

All these cases, excepting the calf, went through a severe attack of Texas fever, to which No. 47 and No. 50 succumbed. The field was therefore infected, so far as this was possible, by sick natives.

In this field were placed two natives (Nos. 132, 133) on August 21. These animals passed through a mild but undoubted attack of Texas fever. In both blood parasites were observed early in October, and the number of red corpuscles shows evidence of infection after the middle of September. Though this experiment is sufficient to demonstrate the ability of sick natives to infect pastures, a much more obvious and striking result might be obtained by an early infection of the fields.*

There are several instances reported of the transmission of disease by sick natives. The Metropolitan Board of New York City reported an outbreak of Texas fever among cattle at Hamptonburg, Orange County, N. Y. (1, p. 954), due to the importation of native cows from Painesville, Ohio, on the Lake Shore Railroad, over which a large number of Texas cattle had been passing. The disease, supposed to have been introduced by the Ohio natives, broke out in October, 1868, and deaths occurred as late as October 24 and 27. The cows brought from Ohio were received August 25, and deaths occurred among them on that day and up to September 10. It is also stated that several native cows died of Texas fever fourteen, sixteen, and nineteen days after exposure to these infected natives. This last statement is open to question, for if our deductions be correct and the general experience of those who have observed Texas fever be trustworthy, it would take from one and a half to two months for such infection to take place.

A very good illustration of the infecting power of diseased natives is that given by F. S. Billings (8, p. 41). According to his statement 1,100 Texan cattle reached Tekamah, Nebr., March 30–31, 1887. Twenty-one native cows put into one of the infected pastures May 1 began to die early in July. On June 19, twenty-four native steers broke into a pasture infected April 1–15 by the Texan cattle. They were returned next day to a pasture containing 114 natives. The twenty-four steers began to show signs of disease July 9, and only two recovered. Curiously enough, Texas fever broke out among the 114 natives, and several were found dead September 21. These circumstances are all perfectly intelligible, if we apply the facts which we have worked out concerning the life-history of the cattle tick and its relation to Texas fever. It is to be regretted that Billings did not make any observations on the ticks present on the infected cattle.

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* A similar experiment in the artificially heated stable with the progeny of ticks matured on sick natives is not conclusive on this point.

We will take it for granted that the Texan cattle brought cattle ticks with them, and that ripe females dropped on the pastures about Tekamah, Nebr., from April 1 to April 15. We have received such from North Carolina in midwinter, which, confined in a paper box in the laboratory, promptly laid a large number of eggs. It might be claimed that at this date the low temperature would destroy the ticks entirely. It is true that low temperatures interfere with the growth of ticks on cattle and with the development of the young tick in the egg, but the embryo is not destroyed, but simply lies dormant until the warmer season approaches. Thus, the experiment station ticks (probably in the egg), actually wintered over on a wooded pasture in 1890–'91. We are indebted to the Weather Bureau for the daily maximum and minimum temperature of De Soto, Nebr., about 25 miles south of Tekamah, from March 30 to May 15, 1887. From this table we learn that the thermometer fell at night below 32° F. only seven times after March 30, and that on April 8 the maximum temperature was 92° F. There was nothing in the weather, therefore, to prevent the ripe ticks laying their eggs. The young ticks probably did not hatch before the middle of June, because the 21 native cows which were put on an infected pasture did not begin to die until early in July. The 24 steers which broke into an infected pasture June 19 began to show signs of disease at about the same time (July 9). This short period of twenty days indicates that the ticks were probably just hatched when these steers broke in.

The time of infection of the large lot of natives by these steers may be easily calculated. They returned from the infected pastures June 20 with young ticks on them. If we allow twenty to twenty-five days for maturing, seven to ten days for egg-laying, twenty days for hatching, ten to fifteen days for the appearance of the fever, and seven to fourteen days for the first fatal case, we have in all sixty-four to eighty-four days from June 20 for the first death among the natives infected by natives. This would bring us to August 23 or September 12 as the probable date of the appearance of the disease originating from ticks which matured on native cattle. The actual date was September 21. Or we may calculate it in another way. When Southern cattle infect the ground by simply passing over it, they do so by dropping ripe ticks ready to lay their eggs. In such a case we usually find a period of fifty-five to sixty days elapse before the first death. In the case before us the 24 steers which broke into the infected pasture June 19 brought only young ticks with them. Hence, to the usual period of fifty-five to sixty days, we must add twenty to twenty-five days to allow the ticks on the native steers to ripen. This would make the period seventy-five to eighty-five days, and the first death might occur between September 3 and September 13, provided the case were acute and rapidly fatal, as is the case in midsummer.

The mortality of such secondary outbreaks due to sick natives is probably very low. In the case before us we are not told definitely by

Billings how many of the 114 head exposed to sick natives succumbed, excepting that several were dead on a certain date. It has already been stated that only those natives which survive, or die after prolonged illness, can mature ticks on their bodies. Hence, where the mortality is very high, the ticks may mature in but small numbers, so that the secondary outbreak due to sick natives may be mild for this reason as well as on account of the advanced season; for there seems to be, up to a certain point, a more or less direct relation between the number of ticks which attack cattle and the severity of the disease.

In regard to the infectious character of sick natives it may be concluded that the infection really exists, and it may be transmitted to other natives by the cattle tick. The severity of the secondary disease will depend upon the time of the first outbreak among the natives and upon the number of ticks matured. It is as a whole not a very serious element, and the losses result mainly from the impoverished condition of the animals which pass through such attacks.

SICK NATIVES ARE HARMLESS WHEN THE CATTLE TICK IS ABSENT.

This investigation is largely of theoretical interest in confirming the experiments which demonstrate that Texas fever is not transmitted from Southern to Northern stock without the intermediation of the cattle tick. Natives are not supposed to be sick excepting as they are infected by the cattle tick, hence the existence of sick natives without ticks must be of such rare occurrence that it is of no practical importance. In the following experiment the disease was produced in native cattle by the intravenous injection of blood drawn from the jugular vein of healthy Southern cattle. For a more complete discussion of these inoculations, the reader is referred to page 265, and to the history of the individual cases given elsewhere. Here we simply mention the fact that the disease was actually produced, and that two natives, placed with such cases as controls, remained well, as is indicated in the annexed table:

Date.	No.	Quantity of blood injected into vein.	Source of blood.	Remarks.
1892.				
July 6	198	28 cc	N. C. cow, 217	Disease begins July 13. Cow dead July 19.
July 6	206	28 cc	N. C. cow, 216	Disease begins July 13. Acute attack followed by relapse in September. Recovery.
July 16	219	28 cc	N. C. cow, 216	Disease begins July 13. Acute attack followed by relapse in September. Recovery.
Aug. 15	222	28 cc	N. C. cow, 214	Disease begins August 18. Recovery.
Sept. 9	230	28 cc	N. C. cow, 214	Disease begins September 14. Recovery.
July 16	218			October 1, exposure negative.
Aug. 15	221			October 1, exposure negative.

The disease began in this field as early as July 13. Five animals had passed through the disease and one had died on it. The control, No. 218, had been in it from July 16, *i. e.*, seventy-seven days up to October 1 without manifesting the slightest signs of infection. The second control spent forty-six days in this inclosure up to October 1, with the same negative outcome.

MAY TEXAS FEVER BE COMMUNICATED BY AGENCIES OTHER THAN THE CATTLE TICK?

We have seen in the foregoing pages that the transmission of Texas cattle fever may be prevented entirely by removing the ticks from Southern cattle in such a way that a new generation is suppressed. We have likewise seen that sick natives may remain in the same inclosure with healthy natives for months without transmitting the disease to them, provided the sick natives have no ticks on them, or, in other words, provided the disease has been produced by direct inoculation. These facts go far toward bringing us to the conclusion that no outbreaks of Texas fever are produced without ticks. Yet we can not deny the possibility of a conveyance of the disease by other agencies, for this possibility is demonstrated by the fact that by a direct transferrence of blood from sick natives, and even from healthy Southern animals, the disease may be reproduced with all its characteristic virulence. We know as yet so little of the ectogenic life of the Texas-fever parasite that whatever hypothesis may be made must remain such until our knowledge has become more defined. Meanwhile we may formulate certain possibilities of transmission without the aid of the cattle tick to call the attention of future observers to them.

It is possible that the disease may be conveyed by insects, which pierce the skin and draw blood. Such pests, when moving from sick to healthy animals very rapidly, may carry enough blood on their mouth parts to inoculate healthy animals. But under such circumstances several factors come into play, such as the probable destruction of the microparasite by drying and other unknown agencies, and the probability that the quantity of blood is too small to contain any parasites. Moreover, a single parasite, or even a few parasites, may not produce anything more than a mild, unnoticed affection. The possibility of direct inoculation by insects may depend on the distribution of insects which draw blood. In the District of Columbia Texas fever was not carried by insects, with the possible exception of a single instance, to be described below, during the four summers of work from 1889 to 1892, inclusive, although the very best opportunities were offered them to carry on direct inoculation, especially during the present summer. There may be parts of our country, however, where such direct inoculation from sick to healthy natives in midsummer is favored by the presence of certain insects not to be found near Washington.

If we consider for a moment the probability of an infection of native from Southern cattle directly by means of flies, etc., we shall find it very slight. Though we now know that Texas fever parasites exist in the blood of presumably healthy Southern animals, we must regard these parasites so scarce in number, if we are to be guided by the microscopic examinations of the blood, that insects can not draw enough blood to become dangerous. The infection of natives by Southern animals in this way must be considered probable only when authentic cases of this disease are on record which appeared ten or fifteen days after contact with Southern cattle, *provided the ground has not been previously infected with ticks from other Southern herds.* There seems to be no carefully investigated outbreak of Texas fever on record which occurred within thirty days of the ground infection or of contact with Southern animals.

In case Southern droves of cattle contain animals actually diseased with Texas fever, their blood would contain more parasites than that of the healthy, and hence might serve more readily as an inoculating fluid for insects, but Southern animals and natives are not allowed to mingle so as to bring this about. The disease is produced, in most cases, where Southern and native cattle do not come in contact at all. If insects distribute Texas fever they could only do it accidentally, and hence the result would be a few isolated cases. But Texas fever attacks 90 to 95 per cent of all natives.

Texas fever, as elucidated in the foregoing pages, is essentially a disease of the blood. The parasite producing it must be transferred in some manner from the blood of one animal to that of another. There is no evidence to support the view that it may gain entrance by way of the digestive tract, and hence several channels by which the microparasite might get into the body are necessarily cut off. Though the parasite is very likely present in the discharges and the urine of the sick, and perhaps in smaller numbers in the excretions of Southern animals, yet pastures infected by such excretions are not infectious. In 1890 the following experiment was made:

Blood and spleen pulp from several natives which had succumbed to Texas fever were scattered over the ground in inclosure V, and two natives pastured in it from August 25 to November. There was no trace of Texas fever discovered in either case, although the blood was examined at three different times. The number of blood corpuscles in one of these animals was below normal, but as it remained at this low point throughout the season, and as the animal had some vaginal discharge, the low number must have been due to disturbances of the generative organs. In the other animal the red corpuscles remained above 5,700,000.

Perhaps the best evidence which can be adduced that the excretions do not have anything to do in transmitting the disease is the experiment in which healthy natives were exposed to sick natives free from ticks for months without any result.

The only exception, and this a doubtful one, to the general result of our experiments and experiences at the station, that Texas fever appears only with ticks on native cattle, occurred in 1891. Field XII (see Fig. 7, p. 256) was used only for the storing of unused healthy cattle during the course of the experiments of that summer. In this field a cow was kept (No. 168) upon which bleeding had been performed a number of times for the study of changes going on in the blood in anæmic conditions. The examination of the blood in this case began August 3 and was continued at intervals to September 8. The animal was led out of the field during each examination to a box, into which she was fastened during the venesection and the collection of the blood. On September 1 No. 162 was received and placed in this field. On September 26 she was observed to be dull and to refuse to eat. The temperature on September 28 was over 104° F. On the following day the animal was found dead. The autopsy revealed an acute case of Texas fever with an enormous infection of the red corpuscles of the blood with the Texas-fever parasite. An examination of the other animals in this field showed that only one other was diseased. This was the case upon which venesection had been practiced, and whose blood had been examined last on September 8. How was this infection brought about? In a preliminary report* the probability of direct inoculation by flies was emphasized. The disease had appeared on the station as early as August 8 in those cases artificially infected with young ticks, and it appeared subsequently in the general-control field VI. Hence the opportunity was afforded for the conveyance of the virus by insects from sick animals. Instead of this channel of infection there is one other possible one. Though no ticks could be found on the animals in this field, a few may have been carried there in the course of the season, or they may have crawled there. A few ticks on an animal may have been overlooked, since they are still quite small when animals succumb in the acute stage. Moreover they may have attached themselves in places not regularly selected by the young ticks (inner aspect of thighs and escutcheon), in which case they would have been quite certainly overlooked. On the whole we must confess that the infection of these two animals is a matter the obscurity of which can not be cleared up. They are the only cases of Texas fever which have occurred on the station fields during the four summers of experimentation which are not directly traceable to Southern cattle carrying ticks, to ticks alone, or to direct transferrence of blood from sick native or healthy Southern animals to susceptible natives by inoculation.

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* Report of the Secretary of Agriculture for 1891, p. 134.

IMMUNITY AND PROTECTIVE INOCULATION—DISTRIBUTION OF DISEASES RESEMBLING TEXAS FEVER ON OTHER CONTINENTS.

IMMUNITY IN SOUTHERN CATTLE.

It has been stated by some observers that Southern cattle soon lose their immunity against Texas fever after they have been taken to Northern pastures, and that they are liable to be attacked by this disease after having been away from the permanently infected territory for a year or longer. These statements, so far as we know, are not based upon experimental evidence, but upon observation of natural outbreaks, and hence the evidence is likely to be weak in one or more points. As we were more or less favorably situated to test these statements, some of the Southern animals were kept on the station grounds for one or two winters and then reëxposed to freshly imported Southern animals, together with Northern stock. These experiments are a part of those already described in connection with ticks, and the following numbers, therefore, belong to the original experiments.

Experiment 8 (*exposure of native to Texan cattle*).—In addition to the natives, a Southern animal (No. 62), brought from North Carolina in 1889, was exposed on this field September 25, 1890, with a native (No. 74). The latter died October 16, while the Southern animal appeared not to be affected. The blood was examined three times. The corpuscles did not fall below five and one-half millions. All adult natives exposed in this inclosure during the summer succumbed to Texas fever.

Experiment 9 (*exposure of natives to North Carolina cattle*).—In addition to the natives placed in this inclosure, the following North Carolina cattle of the previous year were introduced July 4, 1890:

No. 32 (heifer, 3 years). Exposure negative.
No. 59 (cow, 5 years). Exposure negative.
No. 87 (calf of No. 59, 3¼ months). Slight infection.
No. 61 (steer, 2 years). Exposure negative.
No. 67 (cow, 5 years). Exposure negative.
No. 86 (calf of No. 67, 2 months). Slight infection.

From this table it will be seen in the first place that none of the cattle died or became visibly diseased. In Nos. 32 and 59 the blood was examined September 3, when all exposed natives were either sick or dead, and found normal. Nos. 61 and 67 were not examined in this way. In case of the two Southern calves descended from Southern parents, but born on the station, there was a slight infection characterized by the presence of the intraglobular coccus-like stage of the Texas-fever parasite. In No. 87 these were detected September 20, but the blood corpuscles did not fall below five millions, as far as the few examinations are evidence. In No. 86, the younger calf, there was a decided fall in the number of red corpuscles associated with the presence of the parasite in the same stage as in No. 87. The corpuscles numbered but three and one-half millions October 30.

Experiment 14 (*exposure of natives to North Carolina cattle*).—In addition to the natives placed in this field the following Southern animals were introduced July 2, 1891:

No. 55 (cow, 5 years old, from North Carolina in 1889). Exposure negative.
No. 62 (heifer, 3 years old, from North Carolina in 1889, exposed in 1890). Exposure negative.
No. 121 (cow, 4 years old, from Texas in 1890). Exposure negative.
No. 126 (cow, 6 years old, from Texas in 1890). Exposure negative.

These four exposures proved negative (so far as any outward signs of disease are concerned). No. 55 had been away from Southern pastures and not reëxposed for two years. Her blood August 29 was normal. The blood of Nos. 62, 121, and 126 was not examined. In these experiments the examination of the blood was not carried on systematically, and hence no very definite conclusions can be drawn as to the presence or absence of all disease. However, the examination of the blood of adults when made was negative. It is evident that the immunity of Southern cattle is not lost in one year or in two years. And by this we mean insusceptibility so far as a severe attack is concerned, for none of the adults showed any signs of disease, while none of the exposed natives resisted.

It is especially interesting to note that the two Southern calves exposed for the first time were not entirely insusceptible. A mild form of the disease was detected late in the season, and it is not beyond probability to assume that they may have been slightly affected through the entire summer. This seems to make it probable that Southern animals acquire at least some of their immunity by mild attacks very early in life.

NATURAL IMMUNITY OF NORTHERN CATTLE.

Natural immunity of cattle more than 1 year old.—This we know is very slight, for the mortality in many outbreaks has been found to be nearly 100 per cent. Still, there are animals which have more or less immunity, though never exposed to the virus of this disease. By compiling the cases exposed on the station in the ordinary way to Southern cattle in 1889, 1890, and 1891 (experiments 1, 9, and 14), and rejecting all those exposed after September 15, we may obtain approximate percentage of insusceptible cattle. There were exposed in all during these three years 24 head over 1 year old. Of these only one animal remained unaffected, though exposed twice. This was an old cow (No. 57). The remainder passed through more or less severe attacks and five (Nos. 49, 53, 56, 104, and 159) recovered. Some animals, it is true, were killed, but in a dying condition, and these are included with those that died. It may be said, therefore, that about 95 per cent of adult Northern animals are susceptible to Texas fever. When we examine the record of the animals under 1 year of age we obtain a somewhat different result.

There were exposed in the general fields in 1889 and 1890 in all eight calves. Of these two died in 1889 from an acute attack of Texas fever, and two recovered. The remaining four exposed in 1890 were all affected, but none died of an acute attack. The disease was of the more or less mild, prolonged type, with the intraglobular coccus-like stage of the parasite in the blood.* Some succumbed at the beginning of winter from exhaustion, but not so far as could be discovered from the after effects of Texas fever. In general, calves are not insusceptible to Texas fever, but the disease is milder and the mortality is lower than with those more than 1 year old. Attention is here called to the case of a calf which was found dead thirteen days after birth in a field infected with ticks only (experiment 10). The lesions were unmistakably those of Texas fever.

ACQUIRED IMMUNITY OF NORTHERN CATTLE.

This is a problem of far more economic importance than those just discussed, since it affords us some insight into the possibility of producing immunity artificially. The various field experiments of 1889, 1890, and 1891, furnished a number of animals, some of which had passed through a mild attack, others through an acute attack. Many of these were reëxposed the following year to freshly introduced North Carolina cattle in company with fresh native animals. The following summary includes all such exposures. The number of the experiment corresponds in every case to that already described, of which the one under consideration forms a part.

Experiment 9.—The following recovered cases of 1889 were exposed with fresh natives to North Carolina cattle:

July 4, 1890.—No. 51 (cow, 4 years) passed through a mild attack in the fall of 1889.

July 4, 1890.—No. 53 (cow, 2½ years) passed through a fairly severe attack in the fall of 1889.

July 4, 1890.—No. 64 (steer, 3 years) passed through a mild attack in the fall of 1889.

September 20, 1890.—No. 65 (cow, 3½ years) passed through a mild attack in the fall of 1889.

July 4, 1890.—No. 75 (heifer, 16 months) passed through a prolonged attack in the summer of 1889.

In these animals the severity of the first attack is best measured by the intensity of the destruction of red corpuscles. The number of corpuscles in No. 51 had fallen below 1,500,000 on November 4, 1889. In No. 53 they fell to 2,500,000. In No. 64 they had fallen to 2,700,000 on November 7, but there were still many infected corpuscles in the circulation. In No. 65 they numbered only 1,700,000 November 4. No. 75 was not examined. The result of the second exposure in 1890 is, briefly, as follows:

No. 51 dies of an acute attack August 26.
No. 53 probably not affected.
No. 64 passes through a prolonged, but rather mild attack.
No. 65 passes through a mild attack (exposure late) and dies some time after.
No. 75 probably not affected.

Experiment 10.—No. 47 (cow, 4½ years) had passed through a rather severe attack in the fall of 1889. The red corpuscles at that time fell below 1,000,000. July 4, 1890, she was placed in Field VIII, into which only adult cattle ticks had been thrown. She died of an acute attack September 12.

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* It is probable that in all these cases a short acute attack proceded the mild attack.

Experiment 14.—The following recovered cases of 1890 were exposed with fresh natives to North Carolina cattle July 2, 1891:

No. 56 (steer, 4 years) passed through a prolonged attack in fall of 1890.

No. 102 (cow, 7 years) passed through an acute attack (due to ticks only) in summer of 1890.

No. 130 (cow, 6 years) passed through a rather severe attack (Experiment 13) in artificially heated stable (1890–'91).

No. 143 (heifer, 2½ years) passed through a doubtful attack (Experiment 13) in artificially heated stable (1890–'91).

The result of this exposure is, in brief, as follows:

No. 56 passed through a mild attack.
No. 102 was slightly, if at all, affected.
No. 130 died from an acute attack August 27.
No. 143 passed through an acute attack and recovered.

Experiment 17.—In addition to the natives, not hitherto exposed, which were placed into Inclosure VI, in 1892, together with fresh North Carolina cattle and ticks, the following recovered cases were included:

No. 135 reëxposed July 20. This animal had passed through an attack in Field VIII (ticks only) in 1890. This summer it was again attacked, and the red corpuscles at one time were found as low as 2,000,000.

No. 167 was reëxposed on the same day with the preceding. It had passed through an acute attack last year, and was very low for a time. This summer there was probably a slight attack, as the blood corpuscles, though they did not fall below 5,000,000, showed signs of regeneration.

The following cases were reëxposed together on August 26 in the same field, and a hitherto unexposed native, a bull (No. 204), 2½ years old, was put in with them as a control, since the season was now somewhat advanced:

No. 56 had passed through a prolonged but mild attack in the fall of 1890. In 1891 it was again exposed and passed through a short acute attack. This summer there was probably a very short attack, as is indicated by the record of the red corpuscles.

No. 105 had passed through an acute and prolonged fever in Field VIII (ticks only) in 1890, followed by a relapse later on in the same season. A second exposure in September of 1891 was apparently negative. This summer, however, the disease reappeared on exposure, the loss of red corpuscles being fairly severe.

No. 160 was exposed late in 1891 and passed through a short but acute attack, followed by a relapse which lasted into December. This summer the exposure was evidently negative.

No. 166 was infected with artificially hatched ticks in 1891, and passed through an acute and rather prolonged attack. This summer the exposure was negative.

No. 182 passed through an acute attack late last year as the result of the intravenous injection of infected blood. This year the exposure resulted in a slight attack.

No. 185 at the same time passed through a similar attack, due to inoculation. This summer the exposure was negative.

No. 204. The control exposed at the same time in this field passed through a very acute attack, and was probably saved by its age. No. 225, which had just passed through the disease due to an infection with artificially hatched ticks, and whose blood corpuscles had nearly reached the normal, was transferred to this field August 30, four days later than the preceding lot. A second attack was the result, with a rapid and extensive loss of corpuscles. This case is merely introduced to show the intensity of the infection still existing in this field, but it can not be wholly regarded in the light of a control.

The following table gives a brief résumé of these exposures:

Nature of attack.

No.	1890.	1891.	1892.
56	Mild, prolonged	Short, acute	Slight (?).
105	Acute, prolonged, with relapse	Negative	Fairly severe.
135	Acute		Do.
160		Short, acute, with relapse	Negative.
166		Acute, prolonged	Do.
167		Acute	Slight (?).
182		do	Mild, short.
185		do	Negative.
204 (Control.)			Very acute.

These experiments demonstrate the important fact that one attack of Texas fever does not necessarily protect the animal from a second attack. Of the eighteen cases, seven may be said to have remained practically unaffected during the second exposure. Of the remaining eleven three died during the second exposure. It is impossible to determine in such cases how much natural immunity existed before the first attack. Thus No. 53 survived the first attack, while another cow exposed at the same time and nearly of the same age succumbed to an acute attack. No. 75, the heifer which passed through the first exposure as a calf 4 months old, is hardly to be regarded as a fair case. Hence we must be cautious in giving even in these cases too much credit to the first attack in warding off the following one. It is not to be denied that in the case of animals not more than 2½ or 3 years old a first mild attack may prevent a second fatal attack in many cases, and a first acute attack may be followed by a very mild infection, but it may be laid down as a general proposition that a single attack is not sufficient to produce complete immunity.

PROBLEMS CONCERNING PREVENTIVE INOCULATION.

If a single attack of the disease itself does not afford complete protection it is not likely that any process or method of artificial inoculation will be successful in this respect. The profound effect which is necessarily produced in the body of an animal by a destruction of red corpuscles equal in amount to all those circulating in the body at any given time should make much more impression than any method of inoculation is likely to do. And yet such an attack not only does not prevent a second attack but may not prevent death during a second attack. Aside from the difficulties attending the production of insusceptibility under any circumstances the difficulties of preparing a "vaccine" according to the method hitherto practiced are at present insurmountable. The microörganism which we have described as the presumable cause can not be cultivated. Hence the method first practiced by Pasteur of using an attenuated form of the virus itself is not within reach, and other means must be sought. Before suggesting any lines of experimentation in this field let us examine briefly under what conditions it is desirable to have an animal insusceptible to Texas fever.

On pastures north of the permanently infected area Texas fever can be kept away by properly applied preventive measures. Hence the protection of Northern cattle by some artificial process is unnecessary and practically out of the question. It is, however, of great importance to be able to protect from a fatal attack valuable animals which are to be taken South into permanently infected territories. It is probable that if calves be taken they may, without treatment of any kind, survive the infection upon Southern pastures and become gradually insusceptible. But in case of animals more than 12 to 18 months old the first attack might be fatal, and if a preliminary mild attack could be induced by artificial means the fatal effect of a second attack might be averted.

Perhaps the simplest manner of producing a mild, usually nonfatal attack, is to expose cattle on pastures which have been infected with ripe, egg-laying ticks at some specified time in the fall. This time must depend on the climate of the locality where the infection is to be practiced. In the latitude of Washington we found, in 1889, the middle of September a convenient time for the infection. In more northerly latitudes the exposure should be correspondingly earlier. Cattle exposed in this way take Texas fever invariably, but the mortality is practically zero. Such animals may die of a second attack during the succeeding summer, but a second mild exposure during the following autumn may furnish a sufficient protection. Inasmuch as the recovery from even severe attacks of Texas fever is usually complete and not followed by any permanent debility, such mild attacks would not be likely to cause any permanent injury to the exposed animals.

Another method of inducing Texas fever is the injection of blood from cases of Texas fever. Such inoculations are apt to result in a mild attack if practiced after the hot weather of midsummer. The blood of Southern cattle will serve the same purpose, as our experiments carried on this year (1892) have shown. If practiced in early summer the injection of such blood induces a prolonged attack and may cause death. These latter methods of inoculation require either the presence of Texas fever or of freshly imported Southern cattle.[*] The former method of exposure to ticks is on the whole simpler, since it requires no operation, and since ticks are easily procurable from the permanently infected Southern territory. Mild attacks of this kind should be watched with care, and the blood examined from time to time to obtain positive information concerning the severity of the induced attack. The temperature should likewise be taken morning and evening.

Efforts to protect Northern cattle by inoculation were made by Dr. Paul Paquin (9, p. 14). We can not review these experiments in detail. While we must commend the faithful work we must dissent from the method, and hence can not regard it as applicable in practice. The wholly different outcome of our experiments concerning the microorganism and the cattle tick as probably the only transmitter prevents us from accepting any results based upon hypotheses which are now shown to be unfounded. But if we look at the results obtained by Paquin's vaccination we will be convinced that they are far from being satisfactory. Thus Dr. Dinwiddie (9, p. 23) reported a mortality of 100 per cent among nonvaccinated animals, and of 75 per cent among vaccinated animals exposed in Arkansas. Of vaccinated and nonvaccinated cattle sent to Texas 66⅔ per cent of the former, and 88⅔ of the latter, died. These percentages show so little difference between the mortality of vaccinated and nonvaccinated cattle that, bearing in mind the various unknown factors which come into play in such experiments, we may regard the effect of this mode of vaccination as negative. What is meant by the author when he speaks of the virus used in these inoculations as doubtful it is difficult to understand. A culture always contains a definite kind of bacteria, and they are either of the wrong kind or the right kind, and no vaccination experiments should be attempted, or, if attempted, reported without an exact description of the underlying conditions, so that they may be repeated if necessary by others. The real difficulty, however, with these experiments, lies deeper. Vaccination experiments were tried before anything definite was known concerning the nature and causation of the disease, and hence were built on hypotheses of a vague character in place of demonstrated facts. Any reader of the foregoing pages of this report will be satisfied that the diagnosis of Texas fever must now require a careful periodical examination of the blood, and that unless this is carried out the disease may escape observation. Again, all test exposures must be made under precisely the same conditions and not in different inclosures with a doubtful or a variable infection, since we now know that the infection is carried by the newly hatched tick.

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[*] Since the above was written we have determined that the Texas fever parasite was carried in the blood of a North Carolina animal three years after leaving the permanently infected territory.

The statements made above concerning the possible uses of mild infections as means of subsequent protection must be regarded as mere suggestions, which may or may not prove of practical utility on a large scale. They are carried out so easily, however, that they may be tried by anyone exercising a certain amount of care.

IS TEXAS CATTLE FEVER RESTRICTED TO THE AMERICAN CONTINENT?

Among the diseases carried from their natural habitat by intercourse, Texas fever occupies a very prominent position. Existing chiefly as a mild, rarely recognizable, malarial infection in certain regions of our country, it becomes a highly fatal infectious disease when transported beyond its natural confines. The movement of cattle is entirely responsible for the phenomenon. The question naturally presents itself whether such a disease is not to be found in other countries situated as we are. Only an active movement of cattle, such as took place in our country in 1867 and 1868, in the hot months of the year, together with their dissemination over Northern pastures, would demonstrate the presence or absence of such a plague on other continents. But there is evidence even now that a disease resembling Texas fever very closely, if not actually identical with it, exists in Southern Africa and in Europe along the Danube.

SOUTH AFRICA.

In 1883 a report was presented to the English Parliament by a commission of inquiry concerning a disease among cattle in the colony of the Cape of Good Hope known as "redwater." This disease is defined by the commission as—

> an infective and malignant fever in horned cattle, characterized by the passing of urine of a color varying from blood-red to purplish-red, and holding the hæmatin or coloring matter of the blood in solution. One ox can not give another redwater as a smallpox patient can give his disease to his neighbor. Redwater is not contagious in that way. The poison of redwater passes from a suffering animal on to pasturage. What, if anything, happens to the poison at this stage is not fully determined. Another ox feeds over the pasturage thus contaminated and becomes in his turn the sufferer.*

The disease was first observed in 1870. Since then it has been introduced from time to time by oxen used as carriers, which keep up communication with the territory north of the colony. Of the precise manner in which the virus is communicated by the cattle only this was known, that while they did not infect other cattle directly they did infect the ground over which they passed.

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*Supplementary report (1881), p. 3.

The symptoms of this disease are summarized by the commission as follows:

> The beast, when first observed, appears dull and sluggish, with a tendency to leave the rest of the herd; the hair stands erect, like that of an animal on a cold day (a staring coat); the ears hang, and the eyes have a dull, lusterless appearance. In some cases the beasts will cease feeding; in other cases they continue to nibble at the herbage until nearly the last, but in an indifferent manner, indicating that they have no relish for their food. There is generally a dribbling of saliva from the mouth; the nose or muzzle may appear quite moist during the early stages of the disease, but it invariably becomes dry and crusty as the disease advances. Later on, the animal will manifest a disinclination to move, and when compelled to do so, will walk with a dragging, straddling gait, as if weak across the loins. In some cases where the sick beast is left undisturbed, it will remain almost constantly in one place, and while standing with head depressed, and ears hanging, in a drowsy, semicomatose condition, look the very picture of complete nervous prostration. Some such cases will lie down the greater part of the time and scarcely move, and when found dead the head and limbs will be resting in their natural position, as if the beast was asleep. In one very marked case of this kind the colonial veterinary surgeon, on making a post-mortem examination, found the carcass pale and almost bloodless, as if the animal had been bled to death. In other severe cases a twitching and quivering of the muscles will be observed, especially of those situated in the flank and behind the shoulder, while the animal will stand and grind its teeth and curl up its upper lip. The beast's dung during the early stages of the disease is very often soft, with a tendency to diarrhea in some cases; but it almost invariably becomes hard as the disease advances. In some very severe cases, where recovery has taken place, the favorable crisis appeared to be ushered in by a salutary diarrhea. But whether the dung is hard or soft it is generally of a brownish tinge, and mixed with blood and mucus. In milch cows the very first symptom observable is the sudden cessation of milk; and in many mild cases, of which there is generally a considerable percentage in a herd, the only symptoms discernible are a dull, dejected appearance, staring coat, and a slight stiffness for a day or two, after which these symptoms disappear, and the animals resume their usual appearance. Of course, the most prominent and diagnostic symptom in this disease is the color and the character of the urine, which varies generally, as the disease advances, from a pale yellow to a dark port-wine color; in many very typical cases, however, even amongst those which terminate fatally, the urine does not acquire that deep tinge. In many cases, also, even when the attack has been very severe, when the crisis is passed, recovery is very rapid, and it is very remarkable, in such cases, how soon the urine reassumes its normal color and density with the disappearance of the albumen. In other cases, again, where the liver fails to resume its healthy function, the beast will become hidebound and unthrifty-looking, while a thick scurf will form on the skin.

The lesions observed on post-mortem examinations were reported by the veterinary surgeon of the colony as follows:

> On cutting through the skin the flesh is seen to be pale and bloodless, and occasionally of a yellowish tinge; sometimes there is a subcutaneous emphysema and infiltration of yellowish-colored serum. * * *
>
> *Liver.*—This organ is nearly always more or less affected, being augmented in volume, and in many instances altered in texture, and so softened as to be easily broken up with the finger. On cutting into it the ducts are often found filled with bile, and sometimes from the cut surfaces large quantities of black blood escape. The gall bladder is usually full of thick bile, and many have thought that this distended condition of it was in some way the cause of the disease, which is quite a mistaken notion, as this state may be observed in other diseases, and in any case where the process of digestion is arrested, as the bile continues to be secreted and simply collects in its natural receptacle till wanted for use.
>
> *Spleen.*—This viscus I have invariably found affected, it being generally enlarged to three or four times its natural size, and filled with black blood, giving to its external surface a livid blue or black color. On holding it up by one end, it will be found that the blood will gravitate to the most dependent part, showing that the splenic tissue is disintegrated. On cutting into it, black incoagulable blood escapes from the incision.
>
> *Kidneys.*—In a few instances I have found these organs looking quite natural, but,

> as a rule, they are much congested, dark in color, and augmented in volume, and sometimes easily broken down.
>
> During the outbreak of this disease in 1871-'72, many persons noticed engorgement or discoloration of the tissues surrounding the kidneys, while the capsules of the kidneys contained a fluid more or less dark colored.
>
> *Bladder.*—This usually contains urine of a high color, often quite black, but sometimes not much altered in appearance. If left to stand it deposits a sediment, which on examination, is found to consist of mucus corpuscles, hippurates, etc., while the urine itself contains a variable quantity of albumen.
>
> The color I find due to the escape of the hematin of the blood.
>
> *Mouth.*—On the tongue I have sometimes seen dark-colored spots or patches, but this condition is by no means constant, as in many instances the mouth looks quite healthy.
>
> *Rumen.*—In this stomach I have found the inner coat much discolored after the animal has been dead some hours, the epithelium peeling off readily. In other cases when I have opened animals immediately after death, I have not found this condition, though in a few instances I have noticed a slight redness.
>
> *Reticulum.*—This stomach has not exhibited any symptoms of disease in any animal that I have examined.
>
> *Omasum (third stomach).*—In most cases I have found this organ healthy; sometimes I have noticed the leaves slightly reddened, and the vessels radiating from their attached border injected, but I have never observed the sloughing which occurs in cases of rinderpest, and some other diseases, nor ecchymosis either. When I have found the tissues discolored and the epithelium peeling off readily, it has been after the animal has been dead some time, and the same occurs in cattle which have died from other causes. In a few instances I found the contents hard and dry, in others quite soft.
>
> This dry, impacted state is not peculiar to this disease, nor has it anything to do with the cause of it, as some have supposed.
>
> *Abomasum (fourth stomach).*—I have noticed intense congestion of this organ in all cases, with more or less ulceration penetrating to the muscular coat. In some instances there were superficial erosions not extending to the submucous tissue.
>
> The mucous membrane was covered with mucus generally tinged with blood.
>
> *Intestines.*—The small intestines are invariably congested, and in other respects present the same appearance as the fourth stomach. Peyer's glands I have found enlarged and dark in color, but I have not detected ulceration of them.
>
> The large intestines present a similar appearance to the small, but in a lesser degree.
>
> In a few instances a kind of croupous exudation has been seen, and casts of portions of the intestines have passed with the feces.
>
> *Chest.*—In this cavity I have not observed any particular indication of disease, with the exception of patches of ecchymosis in the lining membrane of the heart.
>
> *Brain.*—In the few instances where I have examined the brain I have found the membranes covering it much injected, and yellowish colored serum in the ventricles.

Enough of the report has been quoted to illustrate the striking similarity of this South African disease and Texas cattle fever as regards the symptoms and lesions and the noncontagious character of both maladies. Both are carried by cattle from warmer, permanently infected territories, and in both the pastures become infected. In fact, the commission reports that a certain line exists which represents the boundary of the infected district. This is deducible from the minutes of the proceedings, where the following passage occurs:

> The commission recommend that the southern redwater line, at present drawn at the Umtata River, be strictly respected, and that no cattle, either loose or in yoke, be allowed to cross that line except from a portion of East Pondoland, where no redwater is known to exist, and from such portion of East Pondoland only by certificate.

It is to be hoped that this peculiar disease will be soon made the subject of investigation to determine whether or not it also is transmitted by some specific parasite like the cattle tick, and whether or not it is really the same as Texas fever.

ROUMANIA.

Still better evidence of the existence of Texas cattle fever outside of our own country is furnished by certain investigations made by Prof.

Victor Babes,* of Bucharest, in 1888, concerning epizoötic hæmoglobinuria among cattle in Roumania. According to Babes—

> A peculiar disease devastates, since olden times, the herds of Roumania. Native veterinarians have given it the name gastro-entero-nephritis. Nowhere are references to be found in publications concerning this plague, which formerly was regarded the same as rinderpest. It is not less fearful than the latter in the persistence with which it demands annually thousands of victims from among the most powerful draft oxen, especially in the swampy lowlands of the Danube River. * * * Government commissions had endeavored to determine the nature of the plague in former epizoötics, but neither the infectious nor the contagious character could be determined. The disease was looked upon as a kind of malarial disease.

Its dissemination seems to be largely due to draft oxen. Babes is inclined to consider it as spreading from public drinking places, and that the infection starts from such fountains as centers and extends over a restricted area therefrom. Babes also makes the curious statement that "the disease moves from one end of the village to the other, reaches after a few days a certain place in the village from which it does not spread farther, while those animals in the infected part of the village hitherto spared from the disease may succumb later." It is evident that the way in which the virus is disseminated is not known, and that the above statements are more or less contradictory and need elucidation. It should be borne in mind that the conditions as described by Babes must be very complicated, owing to the employment of draft oxen moving from place to place. No mention is made in these investigations of any ectoparasites.

Symptoms.—The most powerful draft oxen are the chief victims. Cows are rarely attacked; calves never. An animal affected with the disease appears weak, the head and ears droop and the back is arched. The temperature is elevated, the pulse and respiration rapid. After two days some recover, others begin to pass dark-red urine. In such cases emaciation becomes marked, muscular tremors appear, and the temperature rises to 40-41° C. (104°-105.8° F.). The animal now sways and drags its hind limbs after it. The bowels may be constipated or pass liquid, reddish-brown, sometimes bloody stools. The disease may terminate fatally in four to seven days. In rare cases fatal relapses occur after apparent recovery. The urine contains but rarely red corpuscles. Usually albumin and coloring matter of the blood are present.

Pathological changes.—The lesions found by Babes are intermingled with those produced by *Pentastomum*, so that it is difficult to determine which are due to the specific fever and which to the parasites. Of the more important we may extract the following brief statements:

The lungs may be the seat of emphysema and hyperæmia. The heart muscle is pale red, friable. The fluid blood and the clots in the heart cavities are quite pale, indicating a marked loss of coloring matter. The liver is enlarged, in some cases yellowish brown, in others dark brown and rich in blood. Babes dwells upon the peculiar mottled appearance of stained liver sections due to the fact that the central zone of each acinus is in a necrotic condition; *i. e.*, the nuclei have wholly or partly disappeared from the parenchyma cells. This condition is precisely similar to that observed in Texas fever. The gall ducts are not obstructed. The gall bladder contains fluid, orange-yellow bile.

The spleen is always enlarged, black or blackish red, the capsule tense. The enlargement resides in the pulp, which is blackish, disintegrated.

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*Die Aetiologie der seuchenhaften Hämoglobinurie des Rindes. Archiv. für pathol, Anatomie und Physiologie, cvx (Jan., 1889), p. 81.

The third stomach is impacted. The fourth or true stomach is always hyperæmic. As a rule hemorrhagic erosions are found in the pyloric portion, still more frequently flat or deep excavations are observed along the mucous folds, with hemorrhagic base, and covered with a slightly elevated greenish-brown slough, more or less easily removable. The hemorrhagic and œdamatous changes along the digestive tract and its mesenteries seem to be much more pronounced than in Texas fever, but, as stated above, *Pentastomum* may have something to do with these.

The kidneys are surrounded by hemorrhagic, œdematous tissue. Frequently the site of a kidney is indicated by a large blackish, hemorrhagic area. The kidneys are enlarged, the cortical portion dark red. In the pelvis more or less extravasation of blood. The bladder contains much dark-red urine.

The muscalatnre of the body is in parts pale and friable. The membranes of the brain and spinal cord are injected, the nervous tissue rich in blood, sometimes softened and œdematous.

That portion of the work most interesting to us is the description of bodies within the red corpuscles, which are strikingly like the parasite of Texas fever in its intermediate stages. Babes finds peculiar microorganisms, which he calls bacteria within the red corpuscles in the capillaries of the mucosa of the stomach and intestines, in the mesenteric glands, in the liver, spleen, and kidneys. In the mesenteric glands they were found free in masses. In the kidneys they were exceedingly abundant, both free and within red corpuscles. He also detected them in the musculature of the body, sometimes in the marrow of the bones. In the brain and spinal cord they were not found.

Babes describes these peculiar microörganisms when stained in Löffler's methylene blue or methyl violet as squarish bodies, each divided by a light line so as to form a body like a diplococcus. The description is vague, but an examination of the illustrations shows that the corpuscles may contain two such diplococci hanging together at one corner and making an angle with each other. Babes finds also that these organisms can not be stained in sections by the current bacteriological methods. He resorts to the following procedure to avoid the decolorizing action of the alcohol: The sections are stained in Löffler's methylene blue for one hour, then dehydrated in an alcoholic solution of methylene blue. Thence they are transferred to an alcoholic solution of eosin and lastly to aniline oil and xylol.

The author believes that owing to the massing together of the "diplococci" in the mesenteric glands, the capillaries of the mucosa of the stomach and the œdemas surrounding these organs, that they enter by way of the ulcers of the fourth stomach, become disseminated in the blood, and then attack the red corpuscles. The probable truth of the matter is, however, that the bodies which he saw have already been in corpuscles and have been set free by their breaking down.

Bacteriological observations were made on a certain number of cases, of which some are reported. The whole work is regarded as preliminary, however, for the results are by no means conclusive. Several kinds of bacteria were isolated from oxen which had succumbed to the disease. One of these was cultivated with great difficulty, and is fatal to rabbits in about two weeks. Its relation to the disease, though assumed by the author, is not yet proven, since no inoculations are reported which show that it is capable of reproducing the disease in cattle.

In a more recent communication* Babes gives some additional facts bearing on the microörganism of this disease.

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* Verhandlungen des X. internationalen medizinischen Congresses (1890). II. Dritte Abtheilung., S. 104–108.

> The parasites are quite polymorphous. The characteristic form is that of a diplococcus in the interior of the red corpuscle. In other cases there are two or even three pairs of the microörganism in a red corpuscle. The size of these bodies varies. Some individuals are 2 μ, others 0.5 μ in diameter. In the fresh condition they are recognizable within the red corpuscles by their moderate refrangibility and their colorlessness. They do not move within the corpuscles. Stained with methyl violet their interior shows a peculiar line of division. The microbes are more tubular (*tubisch*), with ends rounded off, and they often hang together by means of a fine thread. Stained blue, the bodies are spherical and the chromatic substance is found more on the periphery. The parasites are colored brown in chromate of potash.

It will be observed that this description accords much more closely than the one given in his first communication with that given in this report of the Texas-fever microörganism. Babes has detected no movement or changes of form of the microörganism within the corpuscles. This may be due to the failure to examine the blood during the life of the animal. In fact, his description of these bodies indicates that he has thus far seen them only post-mortem. He also adds the following information concerning the transmissibility of the disease from one animal to another:

> Blood of sick or dead cattle 2 or 3 days old may still produce the disease, but frequently a considerable quantity of fresh blood does not infect them. Undoubtedly this depends upon other conditions of development of the parasite in the animal body. Thus the parasite can only be transmitted once from cow to cow, and inoculations from rabbit to rabbit can only be carried through two or three generations with success. Of twelve inoculated beeves only four contracted the disease.

In our experiments the infectious agent has been transmitted from a Southern cow to a Northern cow, and from this subsequently to four other Northern cows without any diminution of virulence. In fact, three of the four died. As the evidence for the above statement of Babes, that the transmission of the disease can be effected but once from cow to cow is not presented, we can not examine into it more closely.

As to the cultivation of the microörganism, Babes is more cautious in his statements in this second communication. Of 200 inoculated tubes only 12 showed a feeble growth of diplococci of various sizes. These are said to produce the characteristic disease in rabbits with a hemorrhagic œdematous exudate of the peritoneum and great masses of parasites in the same, exceptionally in blood corpuscles. This sounds more like the more chronic forms of the ordinary *septicæmia hemorrhagica* in rabbit. As to the nature of the microörganism Babes now hesitates to express an opinion, and inclines to the view that it may stand between the bacteria and the protozoa.

It is difficult not to come to the conclusion that this disease is identical with Texas fever. The pathological changes are almost precisely the same, and any minor differences are explainable by the assumption that Babes may have largely examined animals after the acute attack had passed away. The microörganisms of both diseases, and their general appearance and habitat, are strikingly alike. The fact that Babes cultivated his organism and produced disease in rabbits is not a strong argument against their identity, for it seems very probable that he may have had under observation one of those not very uncommon bacteria accidentally associated with various disease processes whose form is too small to resemble anything in particular and the cultivation of which is attended with many failures. Such forms are familiar to most working bacteriologists. It is nevertheless impossible to come to any positive conclusion that the Roumanian and the American diseases are the same until the investigations concerning the former are carried beyond the preliminary stage in which Babes has left them.

In the Caucasus* there prevails a disease during the hot season which is called "Tschichir," a name also applied to a kind of red wine, because the urine of affected cattle is red in color. The disease is said to kill thousands of the best cows and oxen annually, and peasants lose the major part of their stock in a few days without being able to do anything to check the disease. The details concerning the disease are very meager. "At first the animal is dull, with drooping head and ears. It champs its teeth, moans, and discharges from its mouth a viscid, foul-smelling mucus. The bowels may be loose or costive and the urine is bright red." From observations of the disease the following conclusions are drawn:

The "Tschichir" has no infectious properties. The disease attacks mainly working oxen, more rarely milch cows, and never young animals. It is more severe and acute in spring than in fall. It does not last more than three weeks in any one locality. In the first week it begins to show itself, in the second it is at its height, and in the third it disappears completely. The flesh of animals which have died of this disease is consumed without any ill effects by the nomadic tribes of the Caucasus.

PRACTICAL OBSERVATIONS AND CONCLUSIONS.

It will undoubtedly be conceded by all impartial readers of the foregoing pages that the economic value of the results derived from these investigations is very promising. As yet they are undeveloped, however, and their true importance can not be estimated. Experiments must be built upon them in various directions. These we have thus far been unable to undertake, owing to the large amount of labor involved in determining the relation of ticks to the disease. In the following pages, in addition to deductions immediately available in the control of this disease, a few suggestions are made in regard to the objects to be attained by further investigations and the manner in which they should be conducted. Those readers technically interested in carrying on such investigations will undoubtedly have read between the lines of the foregoing chapters all that can be suggested here.

DIAGNOSIS.

One of the immediate results of the work is the simplicity and ease with which an outbreak of Texas fever can be positively determined. Most veterinarians and pathologists are able to recognize Texas fever when an acute case presents itself for post-mortem examination. The greatly enlarged spleen, the peculiar coloration of the liver, the thick bile, and especially the hæmoglobinuria, are so obvious that no one trained to a knowledge of the appearance of the healthy organs and excretions in cattle can make a mistake. But all cases are not in the acute stage at the time of death, and one or several of these important pathological changes may be missing or barely recognizable when present. In fact, there may be no animals which can be sacrificed, and all may be on the road to recovery. In such cases even the clinical signs, such as the high temperature, may be missing.

Among the diagnostic characters to be added to the list are the examination of the blood and the presence or absence of the cattle tick (*Boöphilus bovis*). We may now consider it demonstrated that Texas fever outbreaks in the North are not possible without the cattle tick. Isolated cases may occur through other agencies, perhaps, but no general infection of fields or pastures is possible without the cattle tick. Hence, in any doubtful disease where Texas fever is suspected, ticks should be looked for, and in doing so all those facts concerning the size of the ticks on animals in the acute stage and during recovery and their location on the body must be borne in mind. On animals which have passed through the disease the ticks are nearly or quite full-grown, and therefore easily detected. But even when great care is exercised the ticks may be overlooked, or in a late fall infection they may have speedily disappeared. In such cases the examination of the blood will give the necessary information. This requires some skill, and a good microscope with objectives and oculars giving a magnification of not less than 500 diameters is necessary. The method of examination as well as the pitfalls to be avoided in interpreting appearances under the microscope have been discussed at length, and need not be again referred to here. While the presence of the microparasite within the red blood corpuscles, and the changed size and appearance of many of the corpuscles themselves, are usually of sufficient diagnostic value, it is always desirable that the number of red corpuscles be estimated at the same time.

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*T. Praktische Bemerkungen über die im Kaukasus Tschichir (Hæmaturia) genannte Krankheit des Hornviehs. Med. Ztg. Russlands, St. Petersburg, 1853, x, 209.

In the microscopic examination of the blood attention should be paid, first of all, to the presence of the various stages of the microparasite. In the mild type, the minute coccus-like body will be found within the corpuscle, near its periphery. As it is rarely seen in fresh preparations, stained preparations should invariably be examined. In the acute type of midsummer, associated with high fever, the larger, paired, pyriform bodies are always present, but usually in very small numbers. They may be detected as readily in fresh blood carefully mounted as in dried and stained preparations. Next in importance to the microparasite of the disease are the changes induced in the blood corpuscles by the anæmia. In fresh blood the variation in size of the individual corpuscles and the very large size of many (from one and one-half to one and three-quarters times the diameter of the normal red corpuscles) is at once apparent. In properly stained preparations the peculiar granulations and the diffusely stained appearance of a greater or smaller number of the large corpuscles, as depicted on Plate IX and other plates, is quite characteristic. These changes may, of course, be the result of very severe, repeated hemorrhages, and these must be excluded first before the former can be considered as due to Texas fever. The changes in the blood corpuscles may be directly associated with the parasite in the mild type, but they usually follow the parasite in the acute type. Hence they may be the only indication of disease recognizable under the microscope in some cases.

A reduction in the number of corpuscles is a very reliable sign of Texas fever. If we except the occurrence of severe hemorrhages and the feeding of chemical poisons, their number is but slightly, if at all, influenced by diseases of various kinds. In several cases of advanced tuberculosis no reduction was noticed. In fact, there seems to be but little specific action of bacterial poisons on the red corpuscles, while the Texas-fever microbe limits its destructive action entirely to them. Anæmia in cattle seems to be rare, as we found it but once among the many cases under observation. Hence the counting apparatus is of great service in detecting Texas fever in all its phases, and should be used whenever possible.

A summary of the diagnostic characters to be looked for when this disease is suspected would include among others the following salient ones:

(1) Cattle ticks.

(2) Gross pathological changes: Hæmoglobinuria; enlarged spleen; enlarged, yellowish liver; thick, flaky bile; ecchymoses on the external and internal surfaces of the heart.

(3) The microparasite within the red corpuscles.

(4) Modified or changed corpuscles (enlargement, the presence of stainable granules, etc.).

(5) The reduction in the number of red corpuscles.

PREVENTION.

Texas fever in the territory outside of the enzoötic region is the result of the distribution of ripe egg-laying ticks by cattle from the enzoötic region. Hence such cattle should not be allowed on uninfected territory during the warmer half of the year. It is also evident that all cars carrying Southern cattle contain a larger or smaller number of ticks which have dropped off during the journey, and which are ready to lay their eggs. The sweepings of such cars, wherever deposited, may give rise to a crop of young ticks, and these, when they have access to cattle, will produce the disease. Wherever Southern tick-bearing cattle are kept within twenty-five to thirty days after their departure from their native fields they are liable to infect such places, since it requires the period mentioned for the smaller ticks to ripen and drop off. But under special conditions even this period is too short and the Southern cattle may remain dangerous a longer time. This would occur when such cattle remain in any one inclosure long enough (four to five weeks) for the progeny of the first ticks which drop off to appear on the same cattle.

The above points are covered in the regulations of the Department of Agriculture concerning cattle transportation. These regulations insist on the complete isolation of cattle coming from the permanently infected territory between March 1 and December 1 of each year, and on the proper disinfection of the litter and manure from such cattle during transportation. Furthermore, such cattle can only be transported into uninfected territory for immediate slaughter during the prescribed period. These regulations, if properly carried out, would prevent the appearance of Texas fever at any time in those areas north of the enzoötic territory. The only question which now presents itself with reference to them is the efficiency of the prescribed disinfection. It has been shown that the infection resides only in the cattle ticks and their eggs; hence the destruction of these is absolutely essential to make the disinfection of any value. In the present report this question has not been touched upon; therefore, pending the trial of various disinfectants, which is now going on, any discussion or any suggestions are of little value.

The harmlessness of Southern cattle after being deprived of the cattle tick brings up the very important question whether such cattle can not by some means be freed from ticks so that their transportation may go on without any restriction during the entire year. There are several ways in which experiments might be undertaken. Cattle might be subjected to disinfecting washes of various kinds, or else they might be run through disinfecting baths which expose the whole body to the action of the liquid used. Such processes would require careful attention. The survival of a very few ticks might lead to serious consequences, since a single ripe tick averages about 2,000 eggs.

Cattle may be deprived of ticks on a large scale without the use of any disinfection if the following plan be adopted: Two large fields in a territory naturally free from cattle ticks are inclosed. The tick-bearing cattle are put into the first inclosure and kept there about fifteen days. They are then transferred to the second inclosure for the same length of time. Thirty days after the beginning of their confinement they may be considered free from infection. The reason for this procedure is simple enough. The cattle drop the ticks as they ripen in the inclosures. By being transferred to a second (or even a third) inclosure they are removed from the possible danger of a reinfection by the progeny of the ticks which dropped off first. It is evident that such inclosures can only be used once a season, since the young ticks subsequently hatched remain alive on the ground for an indefinite length of time. Such inclosures must not be located where there is a possibility that the ticks might survive the winter.

For cattle which are introduced into the enzoötic territory two modes of prevention may be adopted. Either they are kept entirely free from ticks by confinement in stables or upon pastures known to be free from ticks, or else they are exposed to the infection in such a way as to become insusceptible to it after a time. The first method is open to the objection that ticks may at some time accidentally gain access to such cattle and produce a fatal disease. The second method seems the more rational, provided it can be successfully carried out. We know that Southern cattle are insusceptible to the disease, and the way in which this insusceptibility has been acquired has been already discussed (p. 273). Young animals seem to be largely proof against a fatal infection, although they are by no means insusceptible. The repeated mild attacks to which they are subjected finally makes the system indifferent to the virus. The introduction of young animals into the permanently infected territory, though not without danger, is far safer than the introduction of animals older than one year. The danger of a fatal infection increases with the age of the animal, and is very great in cows over 5 or 6 years old, as is distinctly shown by the experiments recorded in this report.

The subject of preventive inoculation has already been discussed and experiments cited on another page. It has been shown that while in general two mild attacks may not prevent a third attack, this will not be fatal. One very acute attack will usually prevent a second severe attack. Hence it is possible to prevent cattle, even when fairly along in years, from succumbing to a fatal attack by several preliminary carefully guarded exposures to a mild infection. This infection may be produced by scattering ripe ticks in an inclosure, or by placing young ticks on cattle in the fall of the year (p. 278). Protective inoculation of this kind should be carried on at some locality outside of the enzoötic territory carefully chosen for the purpose. A few years of careful experimentation would probably lead to an efficient method which, when definitely formulated in all its details, could be applied in different parts of the country. Such experimentation should, of course, pay special attention to the relative susceptibility of the various higher grades of cattle, a matter which we have been unable to touch upon thus far.

What can the individual farmer or stock-owner do in the event that Texas fever has been introduced into his pastures? From what has been said thus far pastures which have been infected by Southern cattle or ticks from the litter and manure of infected cattle cars should be avoided during the entire summer season. While we know that young ticks may remain alive in jars for two or three months without food, it would be premature to conclude that such is the case on pastures, as the conditions are quite different. Yet everything seems to point to a long sojourn of young ticks on infected fields, and pending the carrying out of experiments to test this question we would recommend that native cattle be not allowed to graze on infected fields until after the first frosts, for even a mild attack in fall before the ticks have been destroyed by frosts is debilitating to cattle. The period of time during which infected localities remain dangerous varies, of course, with the latitude, and would be shorter the colder the climate.

The infection of stables, stalls, and other structures with the ticks should be counteracted by thorough disinfection. The adult ticks and the eggs must be destroyed. As stated above, we know as yet very little concerning the agents which will destroy the vitality of the eggs of ticks, but the use of water near the boiling point may be sufficient, if liberally applied, to destroy the life of the embryos. In the case of litter and manure heaps the thorough saturation with some strong mineral acid in dilution may accomplish the purpose. Ordinary lime, slaked or unslaked, densely sprinkled over infected places, so as to form a continuous layer, may be recommended. The slow incrustation of the egg masses with carbonate of lime may be expected, provided the manure is under cover. Otherwise it will be washed away and may leave the eggs unharmed. In regions outside of the enzoötic territory the absence of ticks may be accounted for by the severity of the winter; hence in unprotected localities disinfection is unnecessary after the winter has set in. But it may occur that in sheltered places the eggs will winter over and the ticks reappear the following spring. Whether such ticks are likely to produce any serious trouble in the absence of Southern cattle we are unable to state definitely. All that we know is that disease may break out when Southern cattle of the preceding year are in the pasture, as was demonstrated accidentally in our investigations during 1891. Hence all infected material should be freely exposed to the frost, even though treated with disinfectants beforehand.

TREATMENT.

If the disease is suspected in a herd, the animals should be searched thoroughly for the presence of small ticks, and the temperature of every animal taken with a clinical thermometer with which every stock-owner should be provided. This, which should be 5 inches long, is inserted well into the rectum and held there three to five minutes. If the temperature is 104° to 107° F., fever is present. The combination of ticks and fever, or the presence of the former in a locality where they do not naturally exist, may be considered a sure sign of the imminence of Texas fever. Though there are at least two species of ticks regularly infesting cattle in the permanently infected territory, these remarks can apply only to the species described in this report, since we know nothing as yet of the fever-producing capacity of the other species (*Amblyomma unipunctata*).

In case the ticks are found on the cattle they should be carefully removed and the cattle transferred at once to uninfected grounds. The cattle should be repeatedly examined for ticks and all found destroyed. While the change of pasture and the removal of ticks may not prevent the attack, nor cut short the disease after it has once shown itself, we feel certain that fewer animals will succumb to it. A single infection is sufficient to cause severe and prolonged disease, as is shown by the injection of infected blood; but the mortality seems to be lower than in natural exposures, where the infection is intensified with every additional tick.

We are unable to recommend any specific remedies to be applied after the disease has appeared, because none have been tried as yet. Quinine and its various preparations fed or injected under the skin may prove of value in destroying the parasite, or perhaps methylene blue, recently recommended for malaria, may be of some service. We hesitate, however, to do more than suggest these remedies, since their efficiency should first be carefully tested by well-planned experiments, which should only be undertaken on a large scale, with a sufficient number of control animals, and guided by a repeated examination of the blood.

The general indications to be followed in attempting to save diseased animals are perfect rest in a sheltered place. Sick animals should not be driven or excited, for the condition of the circulation is such that any effort may bring about rupture of blood vessels and lead to speedy death. The heart, moreover, is always seriously involved, and should not be strained in anyway. Again, the exposure of sick cattle in the sun's heat without shelter is liable to increase the already abnormally high temperature. We have, in fact, observed on unsheltered fields during very hot days a rise of from 2° to 3° F. in presumably healthy cattle during the day, which we must attribute to the effect of the sun's heat. A sheltered place, preferably in the open air, in which the sick animal remains free from the annoyances of other animals, is therefore best suited to its condition. An abundance of pure water should be supplied to aid the overtaxed liver and kidneys to excrete their abnormal products in a more diluted condition. The food given should be readily digestible. It may be on the whole better to withhold food entirely until the high temperature begins to subside, since the various digestive organs are in a congested state and not in a condition to do any work.

The disinfection of infected pastures is out of the question, and must be left to nature in winter. They may, however, be used for sheep, since we have found these animals unharmed after grazing on them during an entire summer. It is highly probable that all other domesticated animals may run over such pastures with impunity, since Texas fever outside of the bovine species has not yet been observed.

CONCLUSIONS.

(1) Texas cattle fever is a disease of the blood, characterized by a destruction of red corpuscles. The symptoms are partly due to the anæmia produced; partly to the large amount of débris in the blood, which is excreted with difficulty, and which causes derangement of the organs occupied with its removal.

(2) The destruction of the red corpuscles is due to a microörganism or microparasite which lives within them. It belongs to the protozoa and passes through several distinct phases in the blood.

(3) Cattle from the permanently infected territory, though otherwise healthy, carry the microparasite of Texas fever in their blood.

(4) Texas fever may be produced in susceptible cattle by direct inoculation of blood containing the microparasite.

(5) Texas fever in nature is transmitted from cattle which come from

the permanently infected territory to cattle outside of this territory by the cattle tick (*Boöphilus bovis*).

(6) The infection is carried by the progeny of the ticks which matured on infected cattle, and is inoculated by them directly into the blood of susceptible cattle.

(7) Sick natives may be a source of infection (when ticks are present).

(8) Texas fever is more fatal to adult than to young cattle.

(9) Two mild attacks or one severe attack will probably prevent a subsequent fatal attack in every case.

(10) Sheep, rabbits, guinea-pigs, and pigeons are insusceptible to direct inoculation. (Other animals have not been tested.)

(11) In the diagnosis of Texas fever in the living animal the blood should always be examined microscopically if possible.

CASES ILLUSTRATING THE VARIOUS PROBLEMS SOLVED BY THE PRECEDING INVESTIGATIONS.

From the large number of cases which have entered into the experiments recorded in the preceding pages, a few are selected and given below. The remainder may be found on record in Bulletin No. 1 of the Bureau of Animal Industry, devoted to Texas cattle fever. The cases have been selected to illustrate the various new facts discovered, both with reference to the nature of the disease and its transmission by means of the cattle tick.

The following brief synopsis will enable the reader to inform himself of the significance of each case:

No. 49 illustrates a severe case of Texas fever with hæmoglobinuria, which finally recovered. It was caused by placing the animal in the same pasture with North Carolina cattle.

No. 56 was exposed to the disease several times, and passed through two rather mild attacks.

No. 76 is a fatal case, produced by placing the animal in a field over which ripe egg-laying ticks had been scattered.

No. 102*a* illustrates the occurrence of Texas fever in calves just born. From the same field as the preceding.

No. 128 illustrates that the disease induced by Texan cattle is identical with that caused by North Carolina cattle.

No. 180 is a fatal case of Texas fever, produced by placing young ticks hatched in the laboratory on this animal.

No. 186 is a fatal case of Texas fever, produced by the intravenous injection of blood from an animal affected with this disease.

No. 198 demonstrates that a fatal case of Texas fever may be produced by injecting into a vein blood of healthy Southern cattle.

No. 49 (native).

[Heifer, 3 years old. Received August 16, 1889, and kept with Nos. 35 and 41 until September 14, when it was transferred to field III (North Carolina cattle with ticks). No indication of disease. Calved February 15, 1890. July 4, 1890, exposed with calf No. 85 in field VI (North Carolina cattle with ticks).]

Date.	Number of red corpuscles.	Parasites in red corpuscles.		Condition of red corpuscles.		Temperature.	Pulse.	Respiration.	Remarks.
		In fresh preparations.	Dried and stained.	In fresh preparations.	Dried and stained.				
Aug. 21, 1890	4,865,000	Some large parasites.	....	Normal	Normal	106.7°	88	48	Removed to-day with calf to field IV (sick natives only). Urine and feces normal.
Aug. 22, 1890	3,579,000	Some bright bodies.	Some large parasites.	....do	....do	106.9	96	63	Losing flesh rapidly.
Aug. 23, 1890	3,162,000	Negative	Negative	....do	....do	105.7	90	45	Urine free from hæmoglobin; sp. gr. 1022. Albumen 0.05 per cent.
Aug. 27, 1890	3,050,000	....do	Some large parasites.	Some macrocytes .	Punctated and tinted corpuscles.	101.5	90	45	
Sept. 4, 1890	2,213,000	Large parasites...	10 per cent large parasites.	....do	....	103.8	84	60	Urine has a deep port-wine color. Sp. gr. 1030. Alkaline. Albumen present. Sept. 5, urine contains less hæmoglobin. Sept. 6, urine free from hæmoglobin.
Sept. 2, 1890	3,800,000	A few bright bodies.	Some large parasites.	Many macrocytes.	....	102.0	90	54	
Sept. 18, 1890	4,400,000	Many bright rod-like bodies.	Negative	....do	....	102.4	....	....	Urine pale, watery. Sp. gr. 1013. Otherwise normal.
Sept. 30, 1890	2,671,000	Some bright, rod-like bodies.	....do	Some macrocytes .	....	100.6	78	24	Urine free from abnormal constituents. Sp. gr. 1040.
Oct. 7, 1890	3,521,000	Negative	Negative	Many macrocytes.	....	101.0	90	24	
Oct. 14, 1890	3,722,000	Some pale, rod-like bodies.	5–10 per cent peripheral cocci.	....	....	101.6	84	42	Bowels rather loose. Odor of feces disagreeable.
Nov. 8, 1890	4,303,000	....do	Negative	....	....	......	....	....	
Nov. 19, 1890	4,920,600	Negative	....do	Normal	Normal	103.4	80	40	Dec. 1. This animal began to lose flesh Aug. 21, and continued to do so until Sept. 5, at which time it was very weak. Since then it has been gradually recovering and has now almost regained its original weight. Temperature very high from Aug. 18 to Aug. 23.
Nov. 13, 1891	5,872,000 (white 16,363)	....	....do	....do	....do	103.2	72	48	Not exposed. In field XII during the summer.

No. 56 (native).

[Steer, 2½ years old, received from Maryland September 14, 1889, and exposed in field II (North Carolina cattle with ticks) and other fields subsequently].

Date.	Number of red corpuscles.	Parasites in red corpuscles.		Condition of red corpuscles.		Temperature.	Pulse.	Respiration.	Remarks.
		In fresh preparations.	Dried and stained.	In fresh preparations.	Dried and stained.	°			
Nov. 7, 1889	6,040,000	Negative	Negative	Normal	Normal				
Dec. 2, 1889	5,422,000	do	do	do	do				No symptoms of Texas fever up to date; slight loss of flesh.
Sept. 8, 1890									Reëxposed in field VI (North Carolina cattle with ticks).
Sept. 20, 1890	6,844,000	Some bright bodies	Negative	Normal	Normal	100.8			A few small ticks on animal.
Sept. 22, 1890	5,640,000	Many bright bodies	do	do	do	106	72	60	
Sept. 29, 1890	5,307,000	A few bright bodies	do	do	do	102	72	36	
Oct. 9, 1890	5,436,000	do	do	do	do	101.6	72	54	One mature and several small ticks on animal.
Oct. 22, 1890	4,666,000	Many bright bodies	10 to 20 per cent peripheral cocci.	do	do	102.3	54	30	
Oct. 25, 1890	2,754,000	do	do	do	do	103	60	24	
Oct. 30, 1890	2,720,000	do	do	Many macrocytes.	Some punctated corpuscles.	101.7	72	36	
Nov. 6, 1890	2,344,000	do	20 to 30 per cent peripheral cocci.	30 per cent macrocytes.	10 to 20 per cent tinted corpuscles.	104.1	60	54	
Nov. 8, 1890	1,984,800	do	30 per cent peripheral cocci.	do	do	104	81	96	No ticks can be detected; steer dull and losing flesh slowly.
Nov. 10, 1890		20 per cent bright bodies.	do			104.2	90	96	Feces yellow; bright intraglobular bodies appear a little larger than before, oval in outline.
Nov. 13, 1890	1,183,000	5 per cent bright bodies.	10 per cent peripheral cocci.		Some hæmotablasts.	103.2	81	41	
Nov. 15, 1890	1,534,000	15 to 20 per cent bright bodies.	do	20 per cent macrocytes.	10 per cent punctated and 5 per cent tinted corpuscles.	101.9	84	78	
Nov. 17, 1890	1,655,000	1 to 2 per cent bright bodies.	1 to 2 per cent peripheral cocci.		5 per cent punctated and tinted corpuscles.	101.5	68	36	
Nov. 21, 1890	2,615,000	A few bright bodies	A few peripheral cocci.			102.7	72	36	
Nov. 26, 1890	[illegible]	do	Negative			[illegible]	[illegible]	36	

No. 56 (*native*)—Continued.

[Steer, 2½ years old, received from Maryland September 14, 1889, and exposed in field II (North Carolina cattle with ticks) and other fields subsequently.]

Date.	Number of red corpuscles.	Parasites in red corpuscles.		Condition of red corpuscles.		Temperature.	Pulse.	Respiration.	Remarks.
		In fresh preparations.	Dried and stained.	In fresh preparation.	Dried and stained.				
Dec. 2, 1890	4,706,000	....	Negative	Some macrocytes	=*	° 102.2	68	40	
Dec. 11, 1890	4,603,400	....	1 per cent peripheral cocci.	....do	=	103	76	48	December 31. Recovery complete so far as outward appearances go.
July 2, 1891	....	....	....	....	....	.....	.....	.....	Reëxposed in field VI (North Carolina cattle with ticks).
Aug. 26, 1891	3,242,000	Negative	Negative	Normal	Normal	106.8	68	38	
Sept. 1, 1891	3,553,000	......do	....do	Many macrocytes.	=	103.2	60	54	
Sept. 12, 1891	3,264,000 (white 9,434)	Several pairs of large parasites.	....do	....do	=	101.2	66	54	Many ticks on animal.
Oct. 13, 1891	4,687,000	......do	....do	....	....	101.2	96	36	
Aug. 26, 1892	6,687,500 (white 15,000)	....	....do	Normal	Normal	101.4	60	60	Reëxposed in field VI (North Carolina cattle with ticks).
Sept. 8, 1892	5,125,000 (white 6,250)	....	....do	Slight variation of size.	=	102.6	76	48	
Sept. 21, 1892	6,365,000 (white 8,750)	....	....do	Normal	Normal	101.2	84	24	Probably a slight attack.

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* The sign of equality signifies the same condition as indicated in the preceding column.

No. 76 (native).—Heifer 1 year old when received, May 20, 1890, from the District of Columbia.

July 4.—It was exposed in field VIII (cattle ticks only).

August 14.—Temperature, 104.1. Blood corpuscles, 4,966,000. In fresh preparations nothing abnormal detected. Stained preparations equally negative.

August 16–18.—Heifer growing thin and weak quite rapidly.

August 18.—7 a. m. Animal walking about, but very weak and unsteady in its movements. At 9 a. m. lying down, unable to rise. Temperature, 99.7; pulse, 124; respiration, 16. The skin almost bloodless. Blood obtained with difficulty from skin incisions. Corpuscles, 3,475,000. In fresh preparations a few double pyriform intraglobular parasites observed. The same detected in stained preparations. As the temperature of the animal was falling rapidly and the animal now unable to rise and evidently dying, it was killed at 11 a. m., by a blow on the head.

Autopsy: On the skin of thighs, escutcheon, and belly a large number of ticks just completing the last moult. Lungs normal. Some adult specimens of *Strongylus micrurus* (both sexes) in terminal bronchi. Heart fibers have undergone cloudy swelling. In blood from the right ventricle scarcely any parasites present. Spleen weighs 1¾ pounds; enlarged; capsule tense; under it a few hemorrhagic patches. On section, pulp dark, still consistent, however. In teased preparations some large cells containing from one to four red corpuscles. No free pigment. In stained preparations not more than 1 per cent of the red corpuscles contain the parasite.

Liver weighs 5½ pounds. Evidently enlarged. Yellowish brown. In fresh sections small areas of the lobules show bile injection, while the fatty degeneration is more or less uniform over the lobule. Occasional interlobular bile ducts appear as yellow streaks. In teased preparations made some hours after death fully 10 per cent of the corpuscles contain apparently round or oval pale bodies from 1.5 to 2 μ in diameter. These are usually in pairs situated a variable distance apart. In some only one, in others four bodies are seen. In stained preparations made at autopsy the parasites are all pyriform in shape.

About 8 ounces of bile in gall bladder. Specific gravity, 1022. Holds in suspension a small amount of flaky yellow material.

Kidneys are of a uniformly dark-brownish red color throughout. Fresh sections magnified appear dusted over with minute reddish pigment granules. The capillaries everywhere distended with blood corpuscles. In those of the medulla it is easy to see with high powers in fresh sections each corpuscle containing one to four parasites. When cover-glass preparations are stained few corpuscles are present, but everyone contains a pair of parasites. Besides these there are numerous free bodies identical with those in the corpuscles.

In the bladder about 3 pints of urine containing a large amount of hæmoglobin so that it is barely translucent in layers an inch deep. Specific gravity, 1017. Slightly acid. On boiling, a brownish flocculent precipitate is formed. In the slight, amorphous deposit a few short granular casts.

Digestive tract: In fourth stomach the mucosa of laminæ pinkish and beset with small elevations having a central hole (worm pits). Numerous specimens of *Strongylus contortus* actively moving. In duodenum specimens of *Dochmius*. Mucosa bile-stained. Worm nodules in ileum. In the upper colon masses of clotted blood in which are imbedded round worms (*Œsophagostoma*).

No. 102a (native).—Calf of No. 102. Born September 1, 1890, died September 13; kept in refrigerator until September 15. The examination was delayed because of other work. It was presumed that the calf had succumbed to other causes, but to our surprise the autopsy demonstrated a marked case of Texas fever, as the following notes will show.

Autopsy: Several small ticks found on skin of thighs. The subcutaneous, as well as visceral fat over the whole body, has a decided yellow tinge.

Heart empty, contracted. Fatty degeneration of fibers. Spleen (weight 13 ounces) was dark, enlarged and softened. Liver (1¾ pounds), firm, brownish red. In fresh sections and teased preparations fatty degeneration of the hepatic cells moderate; nuclei distinct. Occasional spots showing bile injection. Considerable number of minute golden needle-like crystals scattered over the section. In stained preparations about 10 per cent of the red corpuscles in the liver contain each a pair of parasites. Bile thick and full of flaky sediment. Not so dark in color as with adults. Kidneys very hyperæmic, of a dark brownish-red color. In fresh sections capillaries distended with red corpuscles. About 20 per cent of corpuscles invaded by parasites.

About 500 cc. (1 pint) of urine in bladder deeply colored with hæmoglobin, not translucent in layer three-fourths inch deep. Specific gravity, 1022. Reaction, acid; 1.4 per cent albumen (Esbach).

No. 128 (native).—Cow, 12 to 14 years old. Received July 4, 1890, from the District of Columbia, and exposed in field II, to Texas cattle with ticks.

July 25.—Corpuscles 6,360,000. They appear normal in fresh and stained preparations.

July 29.—Corpuscles 5,673,000. Normal in fresh and stained preparations.

July 31.—Corpuscles 5,820,000. Normal in fresh and stained preparations.

September 1.—Dies at noon and examined at once.

Animal in fairly good condition. Weighs about 650 pounds. A small number of ticks of various stages attached to skin.

Blood from a skin incision examined a few minutes after death. In a considerable number of red corpuscles parasites singly or in pairs. The forms are mostly round, rarely spindle-shaped or pyriform, and their diameter is about one-third the diameter of the corpuscle. In several slight changes of outline observable. Besides these some corpuscles likewise contain each one bright body changing its position rapidly. In the fresh preparations are also noticed very minute bacteria-like bodies moving or dancing about free in the plasma. Whether these are mere débris particles in Brownian motion is not determinable. In stained preparations from 20 to 30 per cent of all corpuscles contain the parasite in its large stage. The majority of the infected corpuscles contain each but one body which is usually roundish, rarely pyriform in outline. Occasionally, however, a group of corpuscles is encountered which contain each a pair of pyriform bodies. All parasites stain feebly and show more or less refrangence when examined in water.

Blood from the external jugular and the heart shows the same features.

Heart: Slight, mottled discoloration of muscular tissue of left ventricle. Considerable extravasation of blood under endocardium. Many sarcosporidia cysts in this situation. Muscular fibers in state of cloudy swelling.

Lungs: Considerable interlobular œdema in both ventral and adjacent portion of principal lobes. In the right principal lobe, near the lateral edge, a mass of tissue 1½ to 2 inches in diameter partially hepatized with interlobular effusion of serum.

Spleen large, weighs 4¾ pounds. Pulp dark, almost disintegrated. A few intraglobular parasites and much pigment in lumps, either free or intracellular observed in teased preparations.

Liver weighs about 12 pounds. Very much congested, parenchymatous swelling. Bile injection observed in restricted places and fatty changes absent. Numerous infected corpuscles detected in teased preparations.

Kidneys also intensely congested; the whole parenchyma has a uniformly dark brownish-red color. In sections all capillaries gorged with corpuscles, in some of which parasites are noticed. The epithelium of the convoluted tubules contains much pigment in granules. Bladder contains about 3 quarts of urine, having a very dark port-wine color. In a test tube having a diameter of three-fourths inch this urine is practically opaque. When acidified with acetic acid and boiled an abundant precipitate is formed.

Digestive tract: Mucosa of fourth stomach dark pink. Pits due to *Strongylus Ostertagi* present, and numerous erosions with a depressed hemorrhagic base, from one-eighth to one-fourth inch in diameter. Considerable hyperæmia of the mucosa of the entire small intestine. Pigment patches in cæcum and hyperæmia in the rectum on the longitudinal folds.

This being a very favorable case, examined immediately after death, the following cultures were made:

Blood: Peptone-bouillon, peptone agar with and without glycerine.

Spleen: The same media.

Liver: Agar with and without glycerine.

Kidney: The same.

Bile: The same.

The tubes were inoculated from the blood and the bile, with a looped platinum wire, from the organs, with a straight platinum wire.

These various tubes were kept in the thermostat several weeks, but all remained sterile.

On the other hand, stained preparations of the various tissues show the following results as to the presence of the intraglobular parasite approximately stated:

Blood from the skin contains about 20 per cent of infected corpuscles. The parasites are largely in pairs and pyriform. Blood from the right heart contains about the same number. Blood from the jugular contains fewer (about 10 per cent).

Spleen contains from 10 to 20 per per cent of infected corpuscles. The parasites roundish, chiefly in pairs.

Liver contains from 40 to 50 per cent of infected corpuscles. These are also mostly in pairs and many are pyriform.

Kidneys contain between 80 and 90 per cent of infected corpuscles. These parasites are nearly all double. Some corpuscles contain three and four parasites. There are also an immense number of bodies set free from disintegrated corpuscles in this organ.

No. 180 (*native*).—Heifer, age 2 years, received July 25, 1891, from Maryland. Placed in Field I. From this date to August 4, inclusive, about 20 to 30 young ticks were placed on this animal daily.

July 25.—Temperature, 102.4; pulse, 80; respiration, 48. Red corpuscles, 5,396,800. In fresh preparations a few corpuscles containing bright bodies. Stained preparations negative.

July 31.—Temperature, 104; pulse, 70; respiration, 30. Corpuscles, 4,462,700. Fresh and stained preparations negative.

August 3.—Temperature, 102.1; pulse, 60; respiration, 30. Corpuscles, 4,560,000. Fresh and stained preparations negative.

August 6.—Temperature, 106.7; pulse, 72; respiration, 48. Corpuscles, 4,636,300. Blood examination negative.

August 8.—Losing flesh and becoming weak.

August 10.—Animal very weak and thin. Temperature, 107.7; pulse, 120; respiration, 87. Corpuscles, 1,864,900. In fresh and stained preparations a very small number of corpuscles detected, containing parasites of medium size.

August 12.—Died between 6 and 7 a. m.

Autopsy (9 a. m.). Animal has lost considerable flesh since the beginning of the fever. Weighs now about 400 pounds.

Ticks on the inner surface of thighs, on abdomen, and neck. On the average about one to a square inch. They are still small, about ⅛ inch long.

Heart surface well sprinkled with ecchymoses. These are most numerous on the left ventricle. Both sides of the heart contain rather large, dark, firm clots, that in the right being the larger. Considerable blood extravasation under endocardium of left ventricle, especially marked on septum.

Lungs somewhat œdematous.

Spleen weighs 2¾ pounds. Small blood tumors along the course of the vessels under capsule.

Liver weighs 10 pounds; enlarged, edges rounded off. The parenchyma has a yellowish hue. When examined with a lens the yellow coloration is found limited to the tissue around the hepatic vessels. In fresh sections bile injection appears restricted to small areas. Fatty degeneration well advanced. The hepatic cells contain lumps of pigment, and red needle-like crystals are sprinkled over the section. Bile in gall bladder very viscid, and holds in suspension a large quantity of flocculent matter.

Kidneys deeply congested throughout. In bladder 3 quarts of urine, which has a light claret color. Specific gravity, 1018. Acid reaction. Albumen, according to Esbach, 0.2 per cent. On standing, urates are deposited.

Digestive tract: A few hemorrhages on lamellæ of fourth stomach. In the large intestine more or less pigmentation of mucosa. Contents dry and massed into fine balls. Intestines otherwise normal.

In preparations of heart's blood, parasites are rare. They are in general roundish in outline and but one within a corpuscle. In the liver there are about 1 to 2 per cent; in the spleen still less. In one preparation of the spleen pulp a capillary is seen filled with infected corpuscles only. Each contains two parasites. In the kidney not less than 10 per cent of the corpuscles contain either one or two parasites. The large post-mortem bacillus is likewise present in small numbers.

No. 186 (*native*).—Red cow, from 10 to 12 years old, received from Maryland September 4, 1891, and placed in uninfected field II.

September 8.—Temperature, 102.2; pulse, 72; respiration, 48. Red corpuscles, 4,980,700; white, 13,461.

September 19.—From the jugular vein of No. 181, sick with Texas fever, a syringe full of blood (14cc.) was withdrawn and injected directly into the right jugular of No. 186. The blood of No. 186 was carefully examined microscopically before the injection. In a fresh preparation one minute round body, 1 μ in diameter, seen in a corpuscle, slightly changing place.

September 25.—Temperature, 106; pulse, 72; respiration, 78. Red corpuscles, 4,761,905. In preparations of fresh blood several corpuscles detected with large pyriform parasites, each with a dark point (nucleus?). In stained preparations none observed.

September 26, 2:30 p. m.—Temperature, 107; pulse, 96; respiration, 108. Red corpuscles, 4,333,300. In fresh and stained preparations a small number of corpuscles containing large parasites.

September 28, 2:15 p. m.—Temperature, 101.2; pulse, 108; respiration, 60. Red corpuscles, 2,123,077; white, 4,615. From 1 to 2 per cent of corpuscles contain amœbiform parasites.

The animal stands trembling and quivering, swaying with her hind quarters, and scarcely able to remain on her feet while a few drops of blood are being collected from a skin incision for examination. Soon after she falls down and remains on the ground.

At 3:30 p. m. a syringeful of blood (7 cc.) is withdrawn from a jugular vein to inoculate several pigeons. After this insignificant operation the cow goes into convulsions and dies.

Autopsy notes: Animal has lost much flesh. Weighs now about 700 pounds.

Lungs normal. Heart firmly contracted. Considerable extravasation under the epicardium of left ventricle, much less on the right ventricle. Many ecchymoses and small hæmatomata under endocardium of both ventricles. Heart muscle shows slight fatty degeneration. In the serum expressed from the heart muscle a large number of large parasites both free and within corpuscles. In stained preparations from 30 to 40 per cent of all corpuscles are infected. Many parasites in pairs. (Plate IV, Fig. 5.)

Spleen weighs $4\frac{9}{16}$ pounds. Very much enlarged. Tortuous injected vessels on capsule with hemorrhages along their course. The pulp is very dark and very soft. Malpighian bodies invisible. In teased preparations examined fresh there are many large cells containing from two to eight red corpuscles. Two capillaries seen, in which nearly every corpuscle is infected. Pigment present in small quantities. In stained preparations about 8 to 10 per cent corpuscles contain large parasites.

Liver weighs 14 pounds. Some old adhesions on the right between it and diaphragm. Tissue rather firm, color departing slightly from the normal. Yellowish dots and lines are seen on section corresponding to the zone around hepatic veins. In several larger branches of the hepatic vein are thrombi. In fresh sections and teased preparations, bile injection localized to small areas around intralobular veins. In stained preparations from 20 to 30 per cent of the corpuscles infected.

Bile very thick and flaky, holding a large amount of amorphous matter in suspension.

Considerable œdema in the fatty tissue around kidneys. The organs are in a condition of general congestion; all normal markings effaced or indistinct. Glomeruli prominent. Cut surface granular. Many ecchymoses in pelvis. In fresh sections all capillaries choked with red corpuscles. In stained preparations nearly all corpuscles contain parasites. There are also many free forms. In sections of tissue (hardened in Müller's fluid and alcohol and embedded in chloroform paraffin) stained in hæmatoxylin the engorged capillaries contain only infected red corpuscles (Plate VII, Fig. 2). Structural changes not noticeable.

In bladder, 2 quarts of urine of a dark reddish color. No sediment on standing. Specific gravity, 1015. Feebly acid. About 0.05 per cent albumen (Esbach). Precipitate with acetic acid without heat.

The mucosa of fourth stomach has a bluish red to bright red color. Digestive tract otherwise not affected.

No. 198 (native).—Cow, 7 years old, received June 3, 1892, from Prince George County, Md., and kept on an adjoining farm until June 30, then transferred to field III.

July 6.—Injected into left jugular vein 28 cc. (two syringefuls) of blood drawn from the jugular vein of North Carolina cow No. 217. The transfer of blood from the vein of one animal to that of the other was made in the same syringe and occupied not more than two minutes. The syringe had been warmed previously to 105° F, after being thoroughly disinfected in 5 per cent carbolic acid and boiling water.

The following table gives, in brief, the clinical history of the animal up to the time of death:

No. 198 (native).

Date.	Number of red corpuscles.	Parasites in red corpuscles.		Condition of red corpuscles.		Temperature.	Pulse.	Respiration.	Remarks.
		In fresh preparations.	Dried and stained.	In fresh preparations.	Dried and stained.				
July 5	6,625,000 (white, 8,750)		Negative		Normal	102.5	68	80	
July 7	6,291,666 (white, 10,416)		do		do	103	56	81	
July 9	6,237,500 (white, 20,000)		do		do	102.5	58	48	Stands with back slightly arched.
July 11	5,925,000 (white, 9,625)		do		do	102.2	52	68	
July 13	5,187,500 (white, 6,000)		do		do	105.2	64	96	Drooping of head and arching of back quite pronounced. Appetite unimpaired; continues to stand most of the time.
July 15	5,400,000 (white 10,000)		do		do	104.5	64	80	Falling away in flesh. Very dull.
July 16	4,825,000 (white, 7,500)		Several paired and 7 to 8 unpaired parasites.		do	106.6	56	68	Appetite failing. Loss of flesh continues. Drooping of head and arching of back more marked.
July 18	3,112,500 (white, 5,000)	5–10 per cent irregular, roundish parasites, chiefly single.	As in fresh preparation.	Normal	do	106.4	96	92	Very dull and weak: Lies most of the time on left side with head extended and resting on the ground. Passes much claret-colored urine at 6 and 11:30 a. m.
July 19									Found unable to rise at 6 a. m. Dies at 11 a. m.

Autopsy about one and one-half hours after death. Animal thin; weighs about 600 pounds; has lost about 200 pounds during illness.

Several small areas of intralobular and subpleural emphysema in the principal lobe of both lungs, and in the right ventral lobe. The connective tissue of old pleural adhesions forms a fringe along lateral borders of principal lobes which is in a dark-red hyperæmic condition. A dark red, airless lobule in the right cephalic and the left principal lobe.

Slightly œdemateous condition of the fat around heart case. Very marked ecchymosis of the ventricular surfaces of the heart, the discoloration extending in some places from one-eighth to three-sixteenths of an inch into the heart muscle. Extensive extravasation beneath endocardium of left ventricle; slight extravasation in right ventricle. Blood from the heart coagulates promptly in beakers. The serum is much more deeply colored than that from healthy cattle.

Spleen weighs 5¼ pounds. Capsule very much distended. Pulp dark brownish, still consistent in texture. Malpighian bodies barely visible on section.

Liver weighs 13¾ pounds (without gall bladder). It is paler than normal and shows a peculiar mottling with irregular yellowish-gray patches, each less than 1^{mm} in diameter. On section the organ appears yellowish brown, and the course of the intralobular veins is marked by yellowish-gray borders. In fresh sections fatty degeneration of the parenchyma and the bile stasis quite extensive. Sections were also examined from tissue hardened in Müller's fluid and alcohol. In these after staining with acid hæmatoxylin or alkaline methylene blue, only a narrow region of the acini bordering on the intralobular tissue was found free from necrotic changes. These were manifested by partial or total loss of the nucleus. The capillaries of these areas were in places very much distended and filled with red corpuscles, many of which contained parasites.

In the gall bladder about one-half liter of very thick, flaky bile.

The fat around kidneys contains a moderate amount of serous effusion. Kidneys enlarged (left, 1¾ pounds; right, 2 pounds); capsule readily removable. Parenchyma of a uniform dark brownish red. Much serum flows from the cut surface. The glomeruli stand out as minute blood-red points. The tips of papillæ hyperæmic and the calices of the pelvis surrounding them ecchymosed. Microscopic examination of fresh sections show extreme engorgement of all blood vessels.

Urinary bladder contains 1¼ liters of urine, having a dark port-wine color and barely translucent in a layer three-fourths inch deep. No sediment on standing.

The second stomach adherent to the diaphragm by means of old connective tissue over an area 6 inches square. This tissue dark red, very hyperæmic. The mucosa of fourth stomach in the laminated portion is of uniformly pink color. The pyloric portion is beset with a number of irregular shallow erosions with hemorrhagic base. They vary from one-half to 2 inches in length, and are elongated in shape. The mesentery of duodenum (near portal fissure) is infiltrated with pale reddish serum. Mucosa of small intestine coated with a pasty bile-stained substance representing desquamated epithelium. Mucosa of rectum congested in patches and containing fecal balls.

The pia covering the hemispheres of the brain injected and pigmented. The plexuses are considerably engorged with blood. No fluid in the ventricles, and no abnormal appearance of the brain substance itself. In sections of the cerebral tissue hardened in Müller's fluid and alcohol, and stained in hæmatoxylin capillaries, could be traced for some distance in the white substance underlying the gray, which were filled completely with infected corpuscles. From one of the puncta vasculosa on the cut surface of the white substance of the cerebrum, while still fresh, a bit of tissue was crushed under a cover glass. In it a capillary was traced for some distance containing only infected corpuscles. In the choroid plexus of lateral ventricles many of the gorged capillaries are observed containing infected corpuscles only.

Stained cover-glass preparations from various tissues and organs were examined for infected corpuscles with the following results:

	Per cent.
Blood from subcutaneous vein, about	10
Spleen pulp	10
Liver tissue	10
Hyperæmic spot on omentum	10
Kidneys	50
Heart muscle (excluding free parasites)	30
Brain tissue	2-3
Choroid plexus of lateral ventricles	10-20
Hyperæmic adhesion of second stomach	10
Skeletal muscles	very few.

The parasites appeared in the red corpuscles, both single and in pairs. The numerical relation, in the different preparations, of single and double bodies varied more or less, the former being in some regions in the majority, in others in the minority.

DESCRIPTION OF PLATES.

Every figure illustrative of red blood corpuscles, containing the parasites or modified by the disease, was made from one field of the microscope, and this only, unless especially mentioned to the contrary, in the descriptions below. The drawings are therefore equivalent to photographic reproductions, in so far as nothing was omitted from the field or inserted from other fields (with exceptions to be given). The slight differences in the coloring are due to the different intensity of the stain in the preparations, and were copied as accurately as possible by the artist.

The preparations illustrating blood corpuscles were all drawn with the aid of a Zeiss apochromatic objective, 2^{mm}, 1.30 n. a., and the measurements made with the compensating micrometer ocular No. 6. The occasional variation in the magnification is due to the fact that the earlier drawings were made with the draw tube in, the later ones with the tube length so adjusted that each division of the ocular micrometer was exactly equivalent to 2 μ.

PLATE I. Diseased and healthy spleen.

Fig. 1. Spleen of No. 130.* The smaller ventral end is here represented. Weight of entire spleen 6¾ pounds.

Fig. 2. Spleen of healthy steer killed for beef. The same region selected as in the diseased spleen. Weight 2⅝ pounds.

Note the enormous enlargement of the diseased spleen, the almost blackish appearance of the pulp, and the concealment of the trabeculæ and Malpighian bodies as compared with the healthy spleen. The ratio of the weight of the diseased to that of the healthy spleen is in this case as 2½ to 1, while the weights of the animals is as 2 to 3 (800 to 1,200).

PLATE II. Diseased and healthy liver.

Fig. 1. Liver of No. 50. The figure shows the cut surface at right angles to the peritoneal surface.

Fig. 2. Cut surface of the same liver enlarged two diameters to show the distribution of the yellowish zones along the course of the hepatic vessels.

Fig. 3. Cut surface of healthy liver. The coloring is not properly reproduced in this figure.

Fig. 4. Section parallel to the peritoneal surface of fresh liver from No. 106, in iodized serum. Slightly magnified. The yellow regions correspond to the regions in which the bile capillaries are distended with bile.

PLATE III. Bile stasis and hæmoglobinuria.

Fig. 1. Section from liver of No. 130. Cut on freezing microtome, stained in alum carmine, floated upon the slide, dried in thermostat and mounted in xylol balsam. Drawn with Zeiss apochr. 4mm. and compens. ocular 4. Outlined with camera lucida. (× 250.) The hepatic cells are shown to be inclosed in a network of bile canaliculi distended with rods of solid bile. The space to the left represents the intralobular vein.

Fig. 2. From a fresh section of liver of No. 144, showing the network of injected bile canaliculi and the needle-like, red crystals.

Fig. 3. Rods of solid bile obtained from teased preparations of the liver of No. 184. (× 1,000.)

Fig. 4. Urine from No. 80.

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* Those technically interested in this subject we must refer to Bulletin No. 1 of the Bureau of Animal Industry for the complete history of the cases to which these numbers belong.

PLATE IV. Microörganism of Texas fever.

Fig. 1. Blood from a skin incision of No. 74, taken September 30, 1890. The blood was spread in a thin layer on a cover-glass as described in the text, dried in the air. Subsequently heated for one to two hours in a dry hot-air oven at 110°-120° C. Stained for two to three minutes in Löffler's alkaline methylene blue, washed in water, then dipped for a moment in a one-third per cent solution of acetic acid, washed again, dried in the air, and finally mounted in xylol balsam. The microparasite is represented by the exceedingly minute blue points within the red corpuscles.

In this preparation the infection is shown to be very extensive. This is the only case in which the parasite was detected in this exceedingly minute stage. (× 1,000.)

Fig. 2. Cover-glass preparation of spleen pulp from No. 70. Stained as described in Fig. 1 above. The intraglobular bodies are slightly larger than those of Fig. 1. (× 900.)

Fig. 3. Blood from a skin incision of No. 160. Prepared November 7, 1891. Method as described. The small bodies are situated within the red corpuscles near the periphery. The large red corpuscle in the center containing a number of stained particles of different sizes is a result of the loss of corpuscles, or anæmia. (× 1,000.)

Fig. 4. Cover-glass preparation from kidney of No. 130. Method of fixing and staining as described above. The large, blue body in the center of the group is one of the cellular elements of the kidney. The parasites are usually in pairs, and roundish. This form is generally assumed in the dead body. (× 1,000.)

Fig. 5. Preparation made by rubbing a piece of the heart muscle of No. 186 on a cover-glass, drying and staining as before. In this way the blood corpuscles from the smaller vessels and capillaries are obtained. The large blue body represents a leucocyte. The parasites are mostly in pairs and pear-shaped. (× 1,000.)

PLATE V.

Fig. 1. Cover-glass preparation of spleen pulp from No. 66. The two large blue bodies represent cell elements of the spleen pulp, and the uniformly bluish-pink body represents an "anæmic" red corpuscle. The red corpuscles are mostly larger than normal, owing to the anæmic condition induced in the animal before death. Many parasites are in pairs and have assumed the spherical form. The animal had died in the night. (× 1,000.)

Fig. 2. Preparation made as before from blood taken from a skin incision of No. 106, August 27, 1890, less than twenty hours before death. The appearance of the infected corpuscles in groups, as shown in the figure, was especially marked in this animal. The parasites are mainly in pairs, and pyriform. The stained body on the right is a white corpuscle. The large parasite in a corpuscle to the left was drawn in from an adjacent field. The reddish color of the stained bodies is due to the fact that the preparation was drawn while still mounted in water, which partly dissolved out the coloring matter. (× 1,000.)

Fig. 3. Cover-glass preparation of blood taken from a skin incision of No. 185, October 9, 1891. (Case of intravenous injection of Texas-fever blood.) On this date only about 1,000,000 red corpuscles in a cmm. All objects within the dotted line are in one field of the microscope. The rest are drawn in from other fields in the same preparation; *a* represents modified red corpuscles, *b* a leucocyte, *c* a hæmatoblast, and *d* the parasites. Note the variation in the size of the red corpuscles. The parasites are mainly in pairs. They vary in size and form, and perhaps represent stages of degeneration. (×1,000.)

PLATE VI. Microörganism of Texas fever.

Fig. 1. Vascular fringes on omentum of No. 130, crushed on cover-glass. Dried and stained as before (×1,000). Shows the extensive infection of blood corpuscles in the capillaries. The large blue body represents a cellular element. One corpuscle shows a double infection. The parasites are mainly pyriform.

Fig. 2. Heart muscle of No. 130, crushed on cover-glass, dried and stained to show presence of parasites freed by the disintegration of the infected corpuscles. One corpuscle in the lower part of the figure to the right shows faintly. The two pairs of free parasites above are drawn in from another field.

Fig. 3. Preparation from kidney of No. 74, showing the large number of freed parasites in addition to an extensive infection of the red corpuscles. The free bodies largely in pairs.

PLATE VI—Continued.

Fig. 4. Infected corpuscle, unstained, from cutaneous blood of No. 56, collected November 28, 1890. Each pyriform body is provided with a minute dark body not seen in stained preparations. (×1,000.)

Fig. 5. A similar pair of parasites, unstained, from No. 130. Taken December 30, 1890. (×1,000.)

Fig. 6. A spherical form from the same case at the same time.

Fig. 7. Stained corpuscle from cutaneous blood of No. 137, prepared November 6, 1890, shortly before it was killed, showing how large these bodies may occasionally become with reference to the enveloping corpuscle. Note also the peripheral stain.

Fig. 8. Free parasites not infrequently observed in crushed, fresh, and unstained preparations from the heart muscle of various cases. They are seen usually in pairs.

Fig. 9. A series of corpuscles containing bright motile bodies, observed both in health and disease. Somewhat coarsely outlined.

Fig. 10. Path of one of the bright motile bodies within a red corpuscle, as observed during a period of 15 minutes. Sketched from a fresh preparation of cutaneous blood from No. 107, August 25, 1890.

PLATE VII.

Fig. 1. Capillary from heart muscle of No. 181. From tissue hardened in Müller's fluid and alcohol. Sections cut after imbedding in paraffin and fastened to the slide with a few drops of 70 per cent alcohol. Stained for an hour in Ehrlich's acid hematoxylin and eosin, dehydrated in alcohol containing eosin, cleared in clove oil, and mounted in xylol balsam. There are a considerable number of parasites in pairs within the red corpuscles, the majority of which show only in outline, since they have lost their coloring matter, probably as a result of disintegration. (×500.)

Fig. 2. Capillary from the medullary portion of kidney of No. 186. Nearly every corpuscle contains a pair of parasites. Those drawn in shadow below the optical section in focus are also infected. The section was prepared in the same manner as detailed above, with the exception that it was not fastened to the cover glass and not passed through eosin alcohol. (×500.)

Fig. 3. Capillary containing infected corpuscles almost exclusively. From a teased preparation of fresh spleen pulp of No. 134, in iodized serum. The unstained parasites appear as minute round white spots in the corpuscles. (×500.)

PLATE VIII. Amœboid changes of the microörganism of Texas fever.

Fig. 1. Fresh preparation of blood from No. 69, five hours post-mortem. Preparation sealed with paraffin and kept in a warm chamber with microscope at 35°–40° C. Showing changes of form in an intraglobular parasite.

Nos. 1 to 6, changes going on as fast as could be sketched.

Nos. 7 to 15, sketched twenty minutes later.

Fig. 2. An intraglobular parasite in subcutaneous blood of No. 95 a few hours before death, showing changes of outline.

Fig. 3. Another parasite from the same source, showing similar changes.

Fig. 4. Parasite showing a nuclear (?) body from the same source.

Fig. 5. Similar parasites sketched from the fresh cutaneous blood of No. 90, shortly before death. Note the different forms and relative positions occupied by the intraglobular parasites, as well as the presence of the nuclear (?) body.

PLATE IX. Modified or embryonic red corpuscles after severe hemorrhage and after Texas fever.

Fig. 1. Blood from sheep No. 160, upon which venesection had been practiced. Prepared July 7, 1890, after the number of red corpuscles had been reduced from eleven to five and one-half millions. Dried and stained as for Fig. 1 on Plate IV. Note variation in the size of the normal corpuscles and the presence of large corpuscles containing a large number of stained particles or granules of variable size. (× 1,000.)

Fig. 2. Another field from the same preparation, showing also a tinted form without granules. (× 1,000.)

Fig. 3. Cutaneous blood from cow No. 168, drawn August 12, 1891, after the red corpuscles had been reduced by venesection from six and one-half to two millions. Stained as indicated in Fig. 1. Note the presence of large and small granules in the corpuscles; also a uniformly stained corpuscle. (× 1,000.)

Fig. 4. From another field of the same preparation, showing two large corpuscles containing stained granules. (× 1,000.)

Fig. 5. Cutaneous blood from No. 160 (case of Texas fever). Preparation made November 12, 1891. A corpuscle on the left contains a Texas-fever parasite. (× 1,000.)

PLATE IX—Continued.

Fig. 6. Another field of the same preparation, showing uniformly stained as well as granular red corpuscles. Note also the great variation in size of the corpuscles having a normal appearance. (× 1,000.)

PLATE X. The cattle tick—the carrier of Texas fever.

(Figs. 1, 3, 4, and 5 were drawn under the direction of Dr. Curtice. Nos. 4 and 5 were slightly modified before insertion.)

Fig. 1. A series of ticks from the smallest, just hatched from the egg to the matured female ready to lay eggs.

Fig. 2. Eggs magnified five diameters.

Fig. 3. The young tick just hatched. (× 40.)

Fig. 4. The sexually mature male after the last moult. Dorsal view. (× 10.)

Fig. 5. The sexually mature female after the last moult. Dorsal view. (× 10.)

Fig. 6. A portion of the skin of the udder of No. 140. (Ticks artificially hatched and put on when small.)

Fig. 7. A portion of the ear of the same animal, showing adults ready to drop off and lay their eggs.

PLATE I

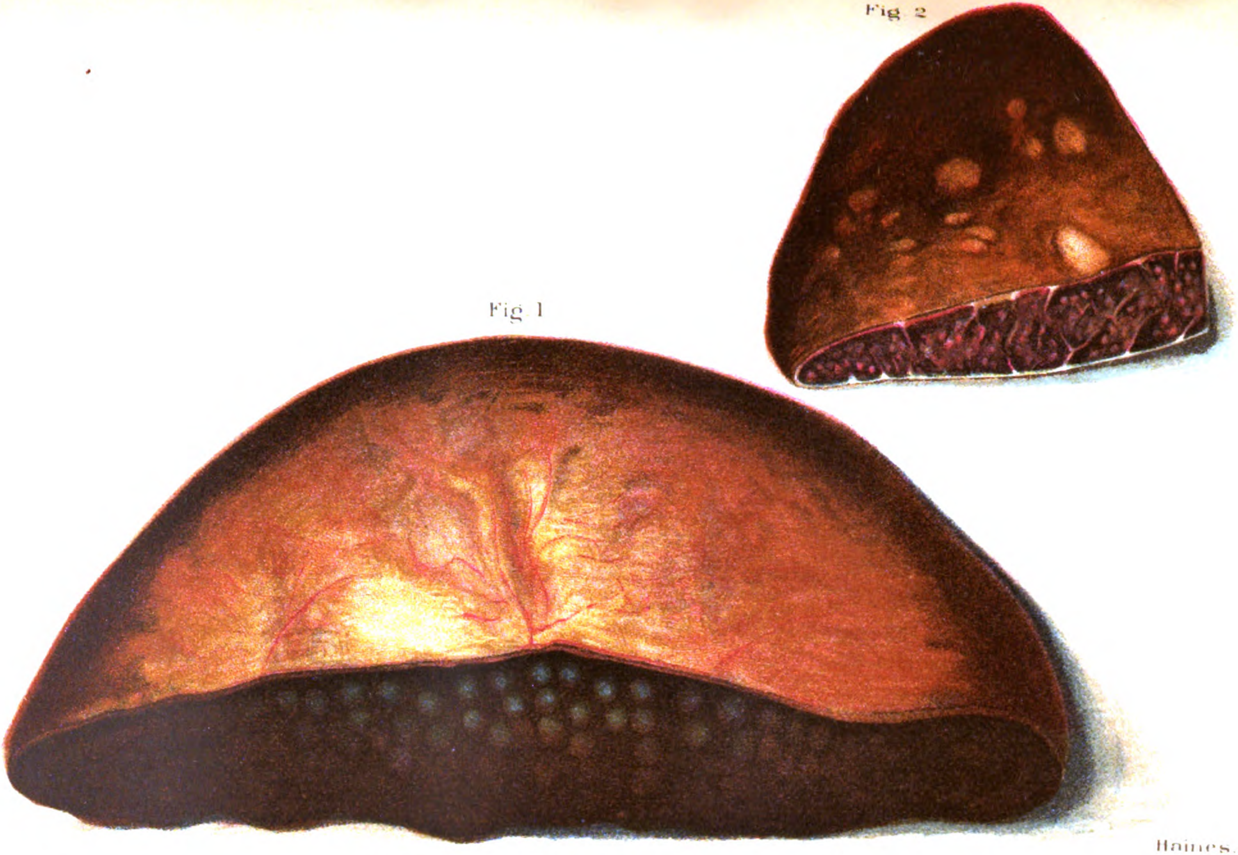


Fig 1

Fig 2

Haines del

DISEASED AND HEALTHY SPLEEN.

PLATE II

Fig. 1

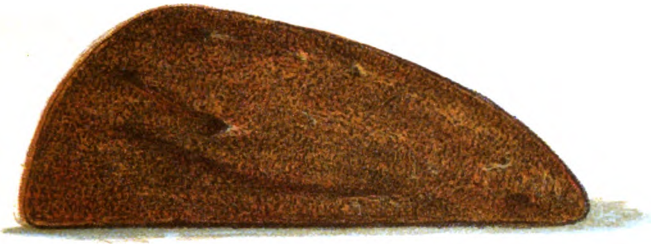


Fig. 2

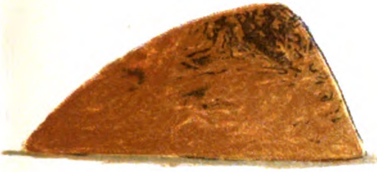


Fig. 3

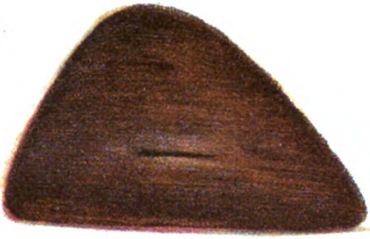
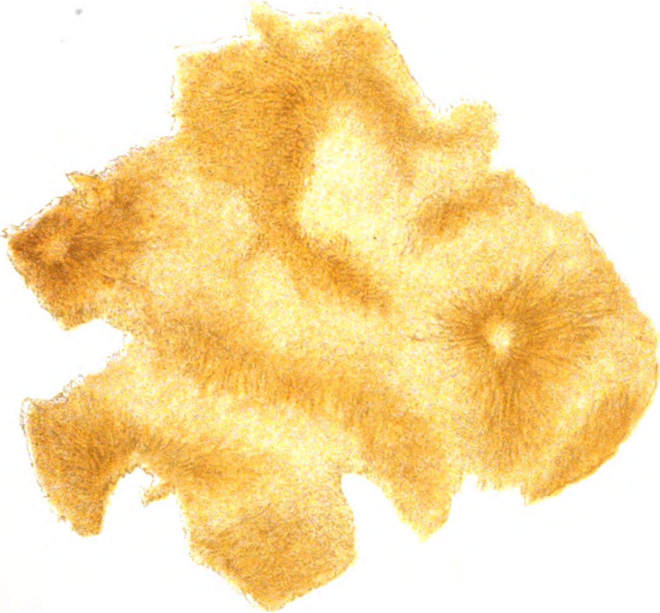


Fig. 4



Haines. del.

DISEASED AND HEALTHY LIVER.

PLATE III

Fig. 2

Fig. 3

Fig. 4

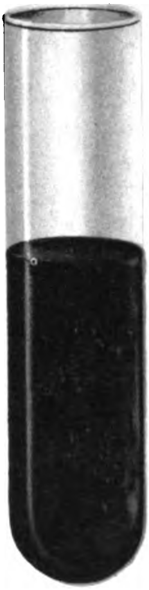
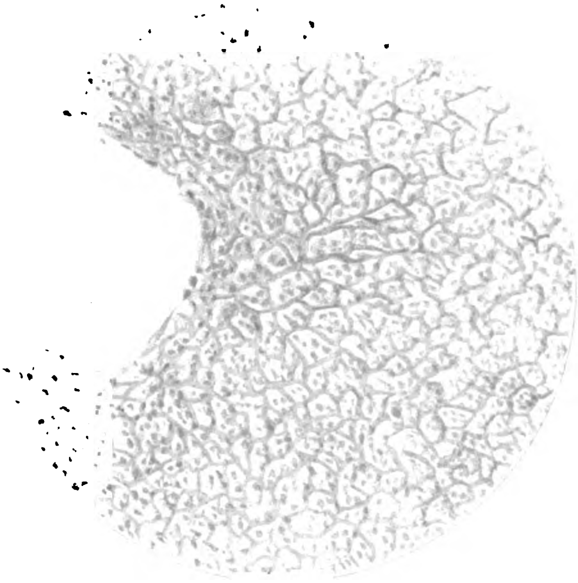


Fig. 1



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BILE STASIS AND HÆMOGLOBINURIA

PLATE IV

Fig. 1

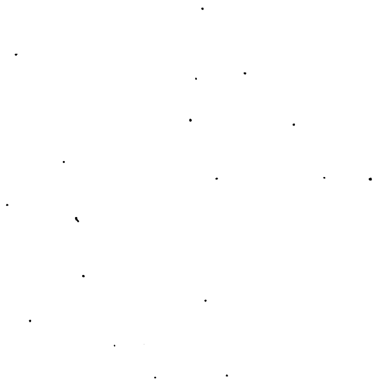


Fig. 2

Fig. 3

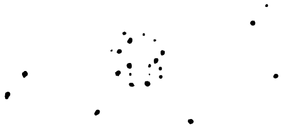


Fig. 4

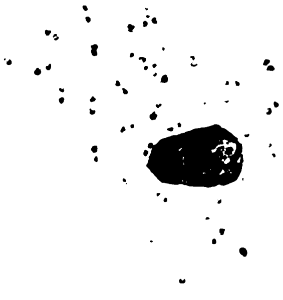
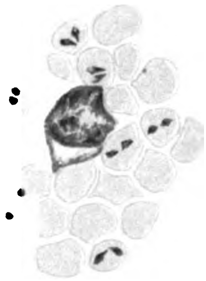


Fig. 5



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[illegible]

MICRO-ORGANISM WITHIN THE RED BLOOD CORPUSCLES.

PLATE V

Fig. 1

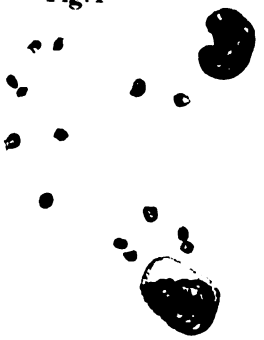
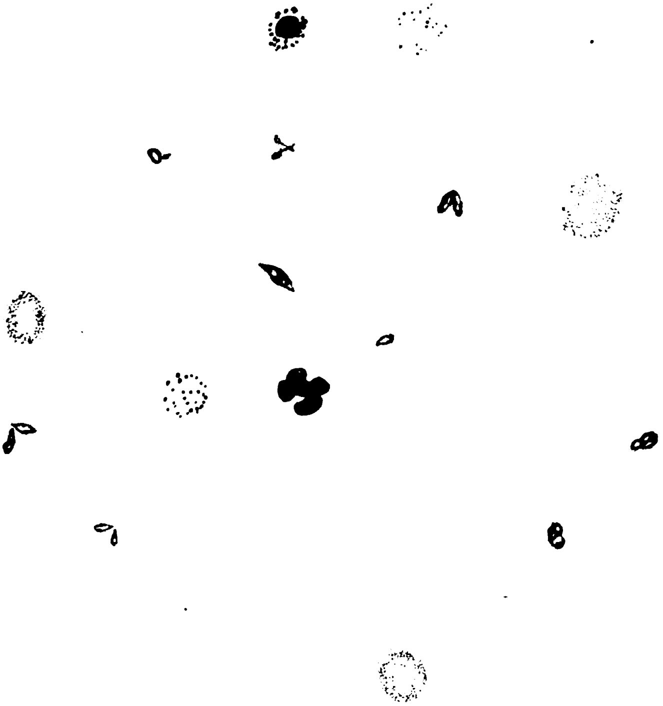


Fig. 2

Fig. 3



[illegible] Litho Co. N.Y.

Haines, del.

MICRO-ORGANISM WITHIN THE RED BLOOD CORPUSCLES.

PLATE VI

Fig. 1

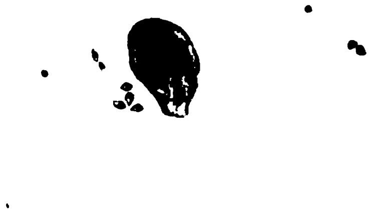


Fig. 2

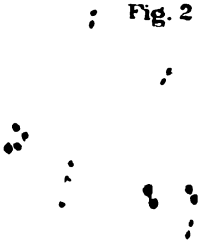


Fig. 3

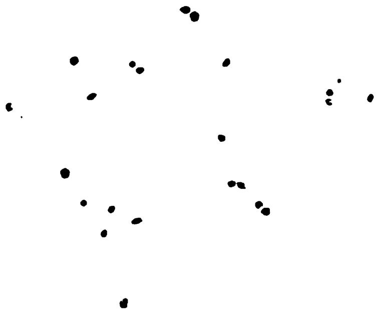


Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 10

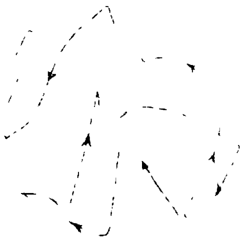


Fig. 8

Fig. 9

[illegible] Co. N.Y.

Haines, del.

MICRO-ORGANISM OF TEXAS FEVER.

Fig. 1

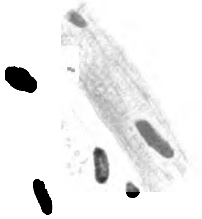


Fig. 2

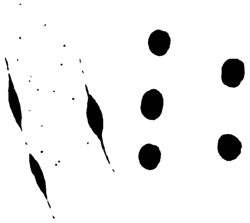


Fig. 3

Haines, del.

CAPILLARIES FILLED WITH INFECTED CORPUSCLES

PLATE VIII

Fig. 1

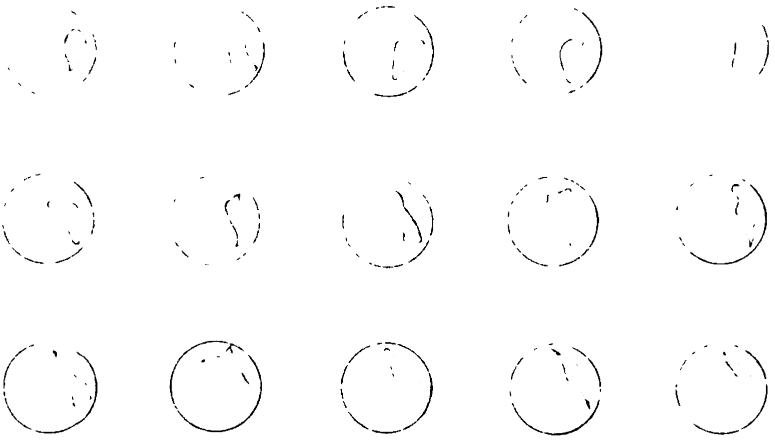


Fig. 2

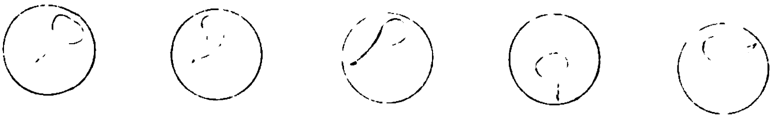


Fig. 3

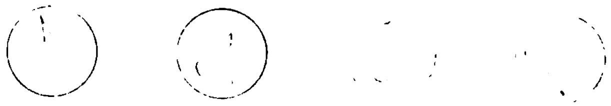


Fig. 4

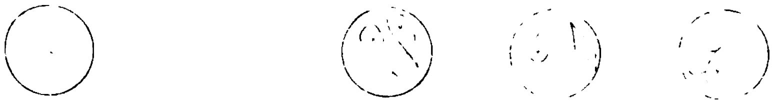
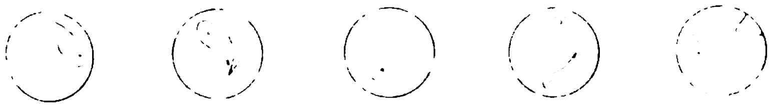


Fig. 5



[illegible] Litho Co. N.Y.

Haines, del.

PARASITE IN THE BLOOD CORPUSCLES
Figs. 1, 2 and 3 show amoeboid changes.

PLATE IX

Fig. 1

Fig. 2

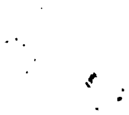


Fig. 3

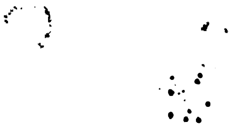


Fig 4

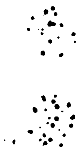


Fig. 5

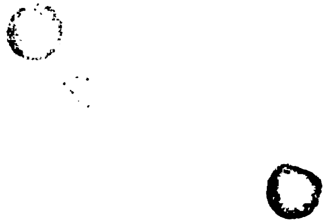
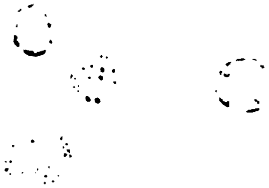


Fig. 6



Haines, del.

MODIFIED (Embryonic) RED BLOOD CORPUSCLES AFTER SEVERE HEMORRHAGE AND AFTER TEXAS FEVER.

PLATE X

Fig. 1

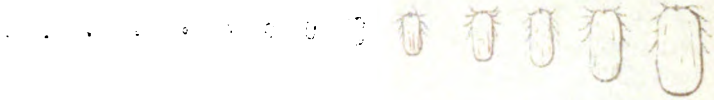


Fig. 2

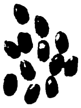


Fig. 3

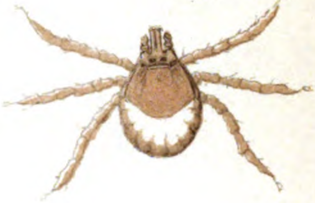


Fig. 4

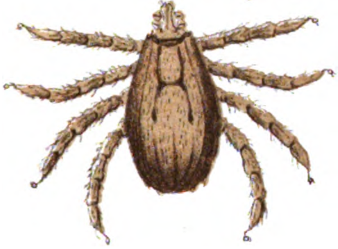


Fig. 5

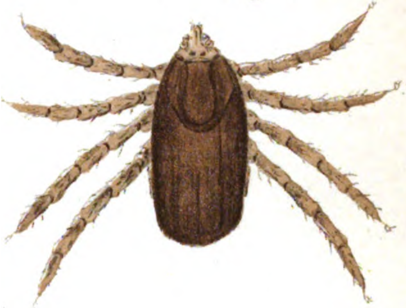


Fig. 6

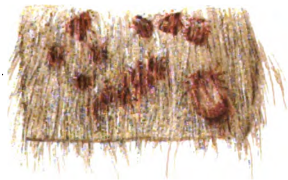
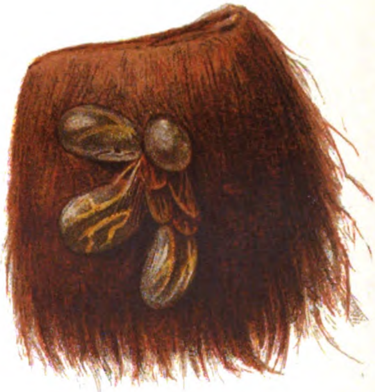


Fig. 7



Sackett & Wilhelms Litho Co N.Y.

Haines, del.

THE CATTLE TICK – CARRIER OF TEXAS FEVER.

CONDITION OF THE POULTRY AND EGG INDUSTRY.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: The following are the results of my investigations into the extent of the poultry and egg industry in the States, which I have been enabled to visit during the period I have been employed as a correspondent of the Bureau of Animal Industry:

THE INDUSTRY IN MASSACHUSETTS AND MINNESOTA.

During the short time I was in Massachusetts in January and February, 1891, my work was confined chiefly to the western part of the State. At Greenfield I visited the extensive yards of Mr. T. S. Lyons, who makes a specialty of Wyandotte fowls. He is the owner and originator of the Storm King family of White Wyandottes. Mr. Lyon claims that Storm King, with his mates, Maud Empress and Lyon's Belle, were America's best pen of White Wyandottes in 1889. This pen is the result of care and correct mating, combined with the all-essential pure unadulterated Wyandotte blood, and is the real foundation of the now popular White Wyandotte family known widely as the Storm King strain. The points of excellence are large size, symmetrical shape, purity of plumage, small comb, beautiful yellow legs and skin; and they are prolific egg producers. Mr. Lyons has been a breeder of blooded poultry for the past ten years, and has given the subject much study. His breeding pens are always cared for by himself; eggs selected and marked; after hatching the chicks are marked and a careful record kept. No medicine or patent food is given, but good grain in its natural state is used. This, with a large range, secures for them health and vigor.

At Adams, Berkshire County, I found quite a large collection of pit stock fowls, owned by Mr. L. A. Jepson. He has some 500 in his flock, of different varieties, and has made game-fowl breeding a specialty for many years. His houses and yards are located on a gravelly knoll facing the south, giving good drainage and ventilation. For egg production Mr. Jepson feeds liberally with young clover cut fine and mixed with cooked food, warm for the morning meal. With this he contends that hens can be made to lay at all seasons when not molting. I found quite an interest in the game fowl in this section; some for the pit, but more because of their good qualities as egg producers and for table use. They are very docile and quiet fowls when properly treated, and make no trouble unless provoked to it.

On the 3d of February I visited the large estate of Lawrence Hopkins, esq., near the village of Williamstown, and was kindly shown through his extensive yards, well stocked with a great variety of fancy, useful, and ornamental fowls. Buff Cochins, Rose Comb, White and Dark Leghorns, White-crested Black Polish, Golden Poland, and game fowls of various kinds are among this collection. The coops and yards were well arranged and kept, and the birds look healthy and strong. Mr. Cole, the manager, thinks a cross of the Poland with Dark Leghorn makes one of the best crosses for general purposes.

Mr. Foster, in the village of Williamstown, has a fine flock of Plymouth Rocks and Wyandottes. From his 30 hens he obtained from 15 to 17 eggs each day through the year. Mr. Foster feeds with wheat bran, oat and corn meal cooked for morning and buckwheat for evening. He prefers buckwheat to corn, it not being so fattening and better for egg production.

At Fitchburg I found several yards of very fine high-grade poultry. Mr. Frank Wood has Golden, Silver-Laced, and White Wyandottes, which he prizes above all other breeds, after many years of experience. His hens begin to lay in August and continue without intermission through the entire winter and spring. His flock has the mark of pure blood, and good care and keeping are shown by their clean and healthful appearance. Harry Litchfield, a lad of some 15 years, has interested himself in poultry, and his flock of 100 Plymouth Rocks and Wyandottes gives evidence of his care and intelligence. His fowls are divided off into yards of a dozen each, and fed with cracked corn, oatmeal, and bran, scalded for morning and the same mixture fed dry at evening. Eggs are produced in great abundance, and he seldom loses a hen by sickness.

At West Fitchburg I visited the poultry yards and incubator factory of Works & Carter. At the time of my call, February 11, they had some 400 young chickens in all stages of growth, from a week to 3 months old. The little chicks are fed chiefly with "gem meal cake" pulverized and given dry, with little strips of meat the size of angle worms added. The firm hatch by their own incubator and are very successful.

At Pittsfield I found a number of poultrymen interested in the higher grades. Mr. Wm. Buckers has had twenty years of experience and speaks well of game fowls. Their flesh is sweet and solid. A 5-pound game will produce as much meat as a 9-pound Brahma, and they are also excellent layers and good mothers.

In March I began my investigations in Minnesota, establishing headquarters at Hastings, Dakota County. In this immediate vicinity I found but little interest in the poultry industry. The farmers all have their flocks of common fowls, freely fed with corn, but poorly cared for otherwise. At Prior Lake, Scott County, Mr. Wm. Hall attempted the business of poultry raising about three years since. Not being able to give it his personal attention, the undertaking proved a failure. At one time he had some 500 hens, 1,000 chickens, and large flocks of geese, ducks, and turkeys. His manager fed liberally, but gave them little other attention. All the fowls were permitted to run promiscuously with cattle, sheep, and swine; in consequence of which the hogs destroyed so many as to wipe out the larger share of the profit. The farmers in this vicinity are very indifferent in regard to their poultry. Occasionally one will send for a setting of eggs of some improved breed, but when hatched the new stock is allowed to mix freely with the old and little permanent improvement is made in the flock. On the 14th of April I made a tour southward and spent three days at Winona. This town is called the headcenter of the Northwest for high-bred and pureblood poultry. The Keier Brothers' yards are located here, and they have a fine lot of Plymouth Rocks, Silver-laced Wyandottes, Rose-Comb White Leghorns, and Black Minorcas. The latter were introduced into the United States several years ago. Mr. Keier thinks they have no equal as egg producers. They lay very large eggs, and, being a nonsitting variety, lose no time in being broody. They are very active, the best of foragers, yet endure confinement well; are also very hardy, have a large, shapely body, breast broad and full, and neat and trim appearance. Well-grown specimens of cocks weigh 8 pounds, hens about 6. They are light feeders and mature quickly, the pullets beginning to lay when about 4 months old.

Mr. Keier's houses and yards are neat and comfortable. The houses are very substantial and warm, having two thicknesses of board and two of tarred paper, with air space between. Ventilation is secured only by opening doors and windows a few minutes in the early morning. The floors are all cemented and the entire building thoroughly cleaned every week. The fowls are much more healthy than when the houses are freely ventilated in the usual manner. The draft of the ventilators, he thinks, is one great cause of roup and other diseases of fowls.

Mr. William Naas has yards of Silver-Laced Wyandottes, White Plymouth Rocks, and White-Faced Black Spanish. He took several premiums on his fowls at the late State poultry show held at Minneapolis. Mr. Henry Hess has a yard of Black Javas, large, handsome birds, of rich glossy black. They prove to be good layers, both summer and winter. His pullets begin to lay at 6 months old. Full-grown cocks weigh about 10 pounds, hens 8. They are excellent table fowls. Mr. Hess prefers a close, warm house for his poultry, free from all drafts.

M. E. Teelshorn is a breeder of Silver-Laced Wyandottes. He prefers this breed for their beautiful plumage, good laying qualities, and excellent table use. Their small, close-fitting rose comb is a desirable point in the cold climate of Minnesota. Mr. Teelshorn's 20 hens averaged him 1 dozen eggs per day for the past three months.

A. M. Thueorn has a fine collection of Brown Brahmas and Partridge Cochins. The Brown Brahmas are very large, heavy birds, and take on fat easily; hence must be fed sparingly if kept as egg-producers. His 40 Partridge Cochins yield him about 30 eggs daily.

At Wabasha and Lake City I found some interest in poultry. Plymouth Rocks and Langshans are the preferred varieties, the latter breed on account of their good laying qualities and easy keeping.

Red Wing is producing some excellent birds. Rev. Joseph Hall has a flock of very fine Silver-Laced Wyandottes, paying him well for their keeping. A. M. Hallgren has a yard of Plymouth Rocks from the celebrated yards of A. C. Hopkins, Lancaster, Mass. Mr. Hallgren believes in high feeding for laying hens; has no fears of overfatness if the fowls are provided with roomy houses and ample yards for exercise.

During the month of May I made additional visits among the farmers and poultry men of Dakota and Scott counties. Mr. John Nelson, of Dakota, is endeavoring to bring out the best quality of his little flock. He favors a cross of the best breeds for egg production, and is confident hens can be made to lay through the entire year with proper feeding and care. His coops and yards are on high, dry ground, with plenty of sunshine in winter and shade in summer. From his 35 hens Mr. Nelson realized a profit of $22.65 the past year, and is confident he can do much better in future, as feed was unusually high in Minnesota. Dr. Finch, in the same township, has yards of Wyandottes, Plymouth Rocks, and Leghorns. Though he is not able to give his personal attention to his poultry, the birds are looking well, but their best laying qualities are evidently not being fully developed. His manager informed me that from 150 hens they procured about 3 dozen eggs per day the past winter.

Mr. Westerson, a miller near by, has 180 hens of different breeds, producing about 5 dozen eggs daily at the present time. Mr. Westerson prefers a mixture of Plymouth Rocks, Wyandottes, and Leghorns for general use.

Many of the farmers whom I have visited in this section and in Scott County are Irish and German, and take but little interest in poultry development. Not a few prefer the common barnyard fowl to any improved breed, as more hardy and better for their everyday use.

Stillwater, on the St. Croix, is a manufacturing town, and supplies a home market for eggs and poultry. I found no improved breeds here, and no interest in that direction. August 11 I went north to Duluth, and spent a week with the poultry and egg merchants of that city and neighborhood; thence westward to Brainerd by the Northern Pacific road. Nearly the entire distance between these cities is sparsely populated and the country unattractive, pine forests and low, untillable land being the chief features. At Duluth there is great activity in poultry and eggs, but it is only as a shipping point. At Brainerd are several yards of improved breeds. Mrs. Mary Martin keeps the Brahmas, Plymouth Rocks, and Leghorns, and Pekin Ducks. Mr. T. E. Staples, at Little Falls, is interested and is doing much to improve the poultry stock in his neighborhood. Also Mr. J. L. Gray, at St. Cloud, who has Black Spanish, Plymouth Rocks, and Leghorns. He prefers a cross of these breeds for egg production.

In September I visited St. Paul and vicinity, looking after the poultry interest in that section. In the outskirts of the city are several yards of very fine Asiatic and American breeds. Mr. J. Botts, an enterprising young man, has just started a yard of Langshans and English Red Caps. He begins with 130 fowls and will increase his stock as his means allow. Mr. C. Parlin has a good collection of Buff, White and Partridge Cochins, and Game Bantams. Mr. Parlin makes a point to keep his stock true to name and feeds for health and purity of blood. Wheat bran and millet he considers the best food for young chickens and laying hens. Especially is it good for hens while they are in the molting stage, as it does not fatten, but has all the feather-producing properties to perfection. Mrs. C. Olsen has a yard of Leghorns and American Dominiques, upon which she took the first premium at the fair last season. J. E. Pitt has Light Brahmas. From his 25 hens he obtained 14 or 15 eggs daily through the entire winter. Mr. Pitt is making preparation for greatly extending his yards in the near future.

W. A. Yates is a breeder of Silver-Laced and White Wyandottes, Single-Comb Brown Leghorns, and Black Javas. Last year he bred the Silver-Laced Wyandotte cock, "Diamond Joe," which scored 94 points, the highest-scoring Wyandotte cock on record. S. L. Morgan breeds Light Brahmas, Golden-Laced Wyandottes, Toulouse geese, and Pekin ducks. His yards are located on the shore of Silver Lake, where his fowls have unlimited range and are large, strong, healthy birds. Mr. Wm. Shultz is another breeder of high-class fowls. Golden Wyandottes, Blue Andalusian, and Red Caps, and Pekin ducks are among his flocks. All are fine birds, scoring from 96 to 97½ points at the State fair. Mr. H. Blakeman breeds Buff Cochins and pit game stock; handles nothing that scores under 90. In the city of St. Paul I found a brisk trade in poultry products. One house handled during five months ending April 30 seventy-two carloads, or 144,000 pounds, of dressed poultry. Five hundred and sixty-three dozen prairie chickens (pinnated grouse) were sold by this house in two days at the commencement of the game season. Another house shipped 240,000 pounds of live poultry during the past summer. In December last this house handled 6,346 pounds of dressed poultry. H. P. Grant informed me that he has shipped 5 tons of live poultry since April 30, and 7 tons of dressed poultry during the five cool months of the present year. I was at Minneapolis on the 9th of September and attended the State fair held near that city. The poultry exhibited at this fair was very fine, showing over forty varieties of the improved breeds; these included Light and Dark Brahmas, Buff and Partridge Cochins, Barred and White Plymouth Rocks, Black Minorcas, all the Leghorns, Cornish Indian Games, Golden-Barred and Silver-Barred Polish, Golden-Barred and Golden-Spangled Hamburgs, Silver-Penciled and Silver-Spangled Hamburgs, Silver-Laced and Golden-Laced Wyandottes, Bantams, Black-Breasted Red Games, Red Pile Games, Gold and Silver Seabrights, Silver Duckwing, etc., and a good showing of ducks, geese, turkeys, and pigeons.

Round about Minneapolis are several yards of high-grade fowls. The Manhattan Park Poultry Ranch, T. F. Curtis, proprietor, is one of the largest establishments of its kind in the State. These yards are located in a natural grove, high, dry, and shady. The buildings are all heated by steam and well arranged for comfort and healthfulness of the birds. The flock now consists of about 1,500 fowls of the leading varieties of improved stock, fancy and ornamental. Mr. Curtis informed me he had expended $15,000 in his buildings and outfit. Broiler-raising is the chief object. With present arrangements he is able to hatch 3,000 chickens every three weeks; these chicks readily sell as broilers in the early spring at $1 each in the city market. I visited several other yards in this vicinity and found excellent fowls well cared for and much interest manifested in their growth and improvement.

On the 16th of September I started westward to visit the central portion of Minnesota, making my first stop at St. Peter. In this neighborhood I found little interest in poultry, but a lively trade in poultry products. At Worthington, Mr. H. J. Ludlow has a yard of very fine Silver-Laced Wyandottes, and is making great effort to improve the standard of poultry in this section of the State. At Luverne I found one person only showing interest in poultry of the higher grade. This was little Miss McMillan, who is doing noble work with her flock of Light Brahmas, all under her personal care and supervision. Her success shows what an energetic girl of 14 can do in poultry-raising. At New Ulm, a thriving German town on the Minnesota River, I found a brisk trade in poultry products and one old German deeply interested in starting a yard of improved breeds. He begins with about 200 fowls of mixed varieties and intends to increase his flock to thousands as time and circumstances will permit. In October I passed through the western and northwestern section of the State. At Glencoe, located in a rich farming country, 60 miles west from St. Paul, the poultry and egg business was active. One firm does most of the shipping. This house sent off 30,000 pounds of live poultry in five months ending September 30, and during three of the past winter months they shipped 40,000 pounds of dressed poultry. They ship one carload of 400 cases of eggs weekly during the season. These shipments extend to the east and west, from Boston to Tacoma, and some to Victoria, British America. There is some interest in producing a higher grade of poultry here, and I found several yards of nice Plymouth Rocks, Brahmas, and Leghorns.

Hutchinson is a lively town, 20 miles north. Here are a number deeply interested in this branch of industry, and they are doing much to interest their neighbors in the same line of business. Fifteen thousand pounds of poultry were shipped from this town in five months ending September 30.

My next stop was at Granite Falls, on the Minnesota River. Here and at Montevideo but little interest is manifested in poultry. At the latter place, however, I found one yard of fine white Wyandots owned and cared for by two brothers of some 12 and 15 years of age. The two lads are very successful in their undertaking, and keep the home well supplied with fresh eggs and nice fat broilers.

Ortonville, at the foot of Big Stone Lake, is poorly supplied with poultry, and eggs are scarce; the same at Breckinridge, some hundred miles north. In this whole section there are not eggs enough produced for home consumption, and no apparent interest in poultry industry is manifested. I found nearly the same condition at Fargo and Moorhead, the center of the great wheat-producing Red River Valley. Fifty miles east, at Fergus Falls, the poultry interest begins to revive somewhat, and I found several yards of blooded stock. At Alexandria and Sioux Center a scarcity of eggs and lack of interest in poultry prevailed. A few shipments of eggs are made at certain seasons, but in fall and winter the supply is far below the demand. Some traces of the higher breeds are seen scattered among their flocks, but no one is making any decided move for improvement.

At St. Paul, on my return, I spent some time in making investigations respecting the egg and poultry industry in that city. During my stay in the city I called on the editor of the Poultry Herald, there published, and urged upon him the importance of stimulating the farmers and all lovers of rural life to a more active work in developing this branch of industry in the great northwest.

Later in the season I visited Farmington and Shaska, two thriving interior towns. At Farmington Mr. W. Judson has a good collection of White and Brown Leghorns, Black Minorcas, American Dominique, and Blue Andalusians. The latter were recently imported from the Isle of Jersey and are proving to be very good layers and an excellent all round bird. Shaska has no interest in improved stock of poultry. One gentleman informed me that some years ago he started a yard of 600 fowls, but failing to make it profitable gave up the enterprise.

In November I spent a week in Minneapolis interviewing the poultry men and commission merchants. In my investigations I learned there were received in that city during four weeks ending November 17 565,620 dozen eggs, and 203,732 pounds of poultry.

The following table will give some idea of the number of eggs handled in twelve months at the places named:

Name of place.	Quantity.	Name of place.	Quantity.
	Dozen.		*Dozen.*
Cannon Falls	162,000	Luverne	112,800
Zumbrota	53,000	New Ulm	646,200
Redwing	319,000	Glencoe	100,000
Stillwater	335,000	Hutchinson	11,000
Duluth	1,277,800	Granite Falls	54,000
West Duluth	87,000	Montevideo	36,000
Brainerd	44,000	Fergus Falls	16,000
Little Falls	51,000	Alexandria	10,000
St. Cloud	52,650	Sauk Centre	9,240
St. Paul	1,020,000		
St. Peter	53,000	Total	4,509,690
Worthington	58,000		

Owing to the peculiar method of marketing eggs it is almost impossible to get an accurate count of the amount produced. My figures will fall short rather than overrun the true number. The wholesale price of eggs throughout Minnesota will average about 12 cents per dozen.

On my return from Minneapolis I visited the State Farm Experiment Station located at St. Anthony Park, midway between the Twin Cities. Here good work is being done in various lines of husbandry, but I was sorry to find that the poultry industry was entirely ignored. The director, however, assured me he very much regretted the absence of poultry in the establishment, and he was determined as soon as possible to add that branch of industry to the Institution.

THE POULTRY INDUSTRY OF NEW YORK AND NEW ENGLAND.

On the 10th of May, 1892, I visited the yard of Augustus Frame and others at Topsfield, Mass. Mr. Frame has some 600 laying hens and 2,000 chickens, and makes a business of growing roasters, which he finds more profitable than broilers. Light Brahmas are preferred for this purpose, on account of early maturity and better adaptation. He sells them when about 4 months old. Mr. Frame has been long in the business and finds it profitable, if one can hatch 50 per cent of the eggs set, and raise half the chickens hatched. Without great care in management failure is certain.

Mr. C. G. Cotton, of the same town, has started a yard of Plymouth Rocks and directs his attention to the raising of broilers. He hatched 500 chickens this season, and is well pleased with the result. Being a beginner he is working with caution, and will extend his yards as experience increases. He has a fine location, high, dry, and sunny. His new house, 100 feet long, when completed, will be a model of neatness and convenience.

At Haverhill I found much interest in poultry culture. Mr. George C. Perkins makes a specialty of Black Javas and thinks them a very desirable fowl for general use. They are about the same size as the Plymouth Rock, plumage a very rich black, with metallic luster and beautiful green reflections. There is a prejudice against black plumage and legs for fowls, yellow legs being preferred. But Mr. Perkins assures me there is no breed of fowls that have a deeper yellow skin. They are very active for their size, the cocks weighing 8 to 10 pounds, hens 6 to 8, and some specimens weigh even more than this. The breast is extra long, and the Javas dress finely for market, giving more breast meat than other breeds of fowls of similar size. The flesh when served on the table does not present the objectionable dark color common to some other breeds, but is very juicy and fine grained. As egg-producers they rank high when properly cared for. The eggs are quite large, ranging in color from medium to dark brown. The hens make good and gentle mothers, and while not persistent sitters are always ready to a reasonable extent for maternal duties. The combs are single and straight, quite large on males and medium on the females. They are very hardy from the first, and thrive well when roughing it. They mature very quickly, pullets beginning to lay when from 5 to 6 months old and continue through the winter months. Mr. Perkins also has Light Brahmas of a very excellent quality.

S. P. Smith has some fine Brahmas, 25 hens yielding him, on the average, 18 eggs daily through the year.

I. J. Webster, near by, is starting a yard of 200 Plymouth Rocks, Leghorns, and other improved breeds, and intends to increase his flock to 600 this season. He has a "hundred-foot" house now building, and other conveniences for a large establishment are soon to follow.

On the 13th I inspected the yards of S. B. Sawyer, Amos True, and others at Amesbury. Mr. Sawyer is breeding Black Minorcas and Silver-Laced Wyandottes. His Minorcas are of the Knap and Northrop strain and very fine. He considers them better layers than the Wyandottes, but in flesh not so sweet and rich.

Mr. True has a yard of 200 White and Silver-Laced Wyandottes, and proposes to increase his stock and go extensively into egg production.

May 19 I visited the yards of Daniel Webster Andrews, at Lynnfield. Mr. Andrews is a retired naval officer, spending the evening of his life very pleasantly in the hill country, raising eggs and chickens for the city market. At present he has about 1,600 laying hens and 1,800 chickens, and hopes to increase to 4,000. Mr. Andrews was one of the first to breed the cross of Light Brahmas and Brown Leghorns, of which his flock is now composed, a very fine buff-colored bird, good size, laying a large, dark egg. He hatches and broods by means of the natural mother, as involving less trouble and more certainty in results than incubators and brooders. His hatching rooms are about 6 by 10 feet, compact and convenient, accommodating from 60 to 70 hens each. The nests are arranged along the sides on shelves entirely inclosed by doors, each hen having a separate compartment undisturbed. In the morning every hen is taken off by hand, fed, and allowed to dust and exercise, then put back and the little door closed. This ends all care for twenty-four hours. Mr. Andrews contends that it is much less care thus to attend 30 hens than one incubator and with more certain results. Ten chicks from a dozen eggs is his average hatch, and 120 eggs per hen is the average annual production. His feed is whole corn, oats, and barley for laying hens. Fish heads from the city furnish the supply of animal food, freshly cooked every morning. His coops or houses are small, close, and warm. Water will not freeze in them during the coldest weather. The location is well protected from cold winds by the surrounding hills and woods, affording his fowls free range. The houses are so arranged that all droppings of the fowls are saved, and amount to some 10 barrels per week in summer and 20 in winter. This is in good demand at $1 per barrel for morocco-dressing.

D. G. Harvey has 2,500, old and young, of Plymouth Rocks, Brown Leghorns, and Light Brahmas. His 1,500 chickens were all hatched by the mother hen and hovered by brooders. Mr. Harvey protects his fowls from lice by scattering dry sulphur freely about the nest and hen while sitting, and the chickens are as free from vermin as when hatched by incubator. Dry food is given the chicks from the beginning. It consists of cracked corn, cracker crumbs, and crushed oats.

E. A. Newhall, of the same neighborhood, has 400 laying hens and 500 chicks, of Light Brahma and Brown Leghorn cross. Also Wilber Monroe, near by, has 300 of the same class. These men are not working for the finer points of feather in their birds, but are interested in raising very handsome, profitable fowls for general use, and seem to have succeeded.

In June I inspected poultry establishments at Stony Brook, Concord, Watertown, the Newton villages, and several in the immediate neighborhood of Waltham. In the last-named town are the extensive yards of William E. Bright, esq., under the supervision of P. J. Osterman, an educated Swiss, who has made poultry culture a study for the past fifteen years. Everything in this establishment is kept in the most scrupulously clean and orderly condition, and managed with great regularity and punctuality. There were some 300 young chickens, bright, healthy, and strong. Mr. Osterman's manner of managing his young stock is peculiar. For the first twenty-four hours after hatching not a particle of food is given; then white of egg and cracker crumbs moistened with milk are fed at intervals of three hours for the next twenty-four. After this he begins feeding with crushed oats, cracked corn, and green grass chopped fine, and continues with the greatest variety thereafter. The result of this manner of treatment, Mr. Osterman assures me, is a loss of less than 2 per cent of the number hatched. Mr. Bright's stock consists of Plymouth Rocks, Wyandottes, Light Brahmas, and Leghorns. His fowls are all fed at 5 in the morning and at regular intervals during the day. Each fowl has all it will eat readily and no more; no food is wasted. The houses are thoroughly cleaned every morning and liberally sprinkled with sawdust, rendering them pure without the slightest unpleasant odor.

At the Poor Farm, Waltham, Mr. Horace Bumfer, superintendent, has a good flock of Light Brahmas, his favorite breed for general use. For eggs alone Mr. B. prefers the White Leghorn.

J. Kinoin, at Stony Brook, is raising Plymouth Rocks. He has 700 chickens hatched in March and April, all bright and thrifty. Mr. Kinoin takes his chicks from the mother hen when they are three weeks old and confines them in little coops holding about 50 each. After two days, the chicks are allowed their freedom, going in and out at pleasure, each finding its own coop and seldom entering that of its neighbor. The grounds are well located under a wooded hill facing the south. A 500-foot poultry house gives shelter and protection at night; during the day the entire flock is allowed to roam unrestrained through woods and fields.

On the 17th I inspected the yards of Geo. Hubbard, an enterprising young man of 16, at Concord. He is raising a very fine flock of Wyandottes. Two years ago, young Hubbard began with 30 fowls; last season his stock increased to 200, and now he has 700, of rare beauty. He intends to go on increasing and make egg production a permanent business. From the beginning he has had entire charge and shows good taste and judgment in management. I found other yards in town, but none of marked interest or development.

At Highland Farm, Waltham, N. E. Smith has Silver-Laced and White Wyandottes and Light Brahmas. Mr. Smith has taken several premiums on his birds in the past, and with a little more care in their keeping I think would be still more successful in future. He has been quite unfortunate with his young chickens this season, losing a large proportion soon after hatching. His experience with the incubator is not favorable; eggs hatch well enough, but the chickens seem weak and many die.

Mr. W. B. Atherton, at Newton Lower Falls, is raising Barred Plymouth Rocks and Wyandottes. He has eight breeding yards, with 200 fowls and 300 chickens. Mr. Atherton considers the Barred Plymouth Rocks good as an all-round fowl. It is a distinctly American breed, though popular in other countries; very hardy and well adapted to all climates. His birds are very carefully bred and are a combination of the Essex and Drake strains. Of the Wyandottes Mr. Atherton likes the White, being compactly built and excellent layers and mothers. By careful breeding they have been brought up to a high standard both for exhibition and utility.

At Newton Upper Falls I found several yards of very fine stock. Smith & Son had a good showing of Plymouth Rocks.

James Trowbridge has some 300, including Light Brahmas, Buff and White Cochins, Plymouth Rocks, Speckled Hamburgs, and Black Minorcas. The Speckled Hamburg is a small breed, but the hens are great layers, even surpassing the Leghorn. Mr. Trowbridge is well pleased with his Black Minorcas, as he finds them good for eggs for the table.

At Newtonville, Mr. C. W. Richards is raising a good stock of Plymouth Rocks and Light Brahmas. His yards are well kept and his fowls are in excellent condition. Mr. Richards has had many years of experience in poultry culture and has paid much attention to the hatching and breeding of chickens. He regards the lack of moisture in the nest of the sitting hen as one great cause of failure in hatching. To avoid this trouble he arranges his nests to come in contact with the moist earth by placing bottomless nest boxes on the ground. Buckwheat is Mr. Richards' favorite food for laying hens, with a little corn in summer. Two hundred eggs yearly from each hen is his average.

R. C. Bridgham, of the same village, has some very good Plymouth Rocks and Light Brahmas, well-built houses and good yards, but more care is needed in the management of his fowls.

At Watertown on the 24th I found several who are interested in poultry of high class. N. B. Hartford has Brown Leghorns and Golden Laced Wyandottes, Pekin Ducks, and Fantail Pigeons. His flock of a hundred Brown Leghorn chickens of a month old was the prettiest group of the kind I have ever seen.

N. C. Lathrop has yards of Golden Laced and White Wyandottes, Plymouth Rocks, and Brown Leghorns. Mr. Lathrop's favorite breed is the White Wyandotte, both for eggs and the table. His hens average about 120 eggs yearly, each.

E. H. Brown is a dealer in poultry for the Boston market, handles 100 tons or more yearly, but encounters strong competition in shipments from the West.

I found a very fine yard of Indian Game fowls at Newton Center, owned by Mr. James Cutter, a poultry man of many years. Mr. Cutter has tried most of the improved breeds, but none please him as much as the Indian Game. They are docile, hardy, solid, and compact in flesh, and easily kept. The pullets commence laying at 6 months old and continue prolific in eggs. A young cock I examined weighed nearly 10 pounds, handsome, solid, and very deceptive in weight until actually handled.

I also visited the yards and grounds of R. H. White, esq., located at "Chestnut Hill." Mr. White amuses himself with fancy stock, of which he has quite a variety, consisting of Golden Spangled Hamburg, Golden Penciled Hamburg, Silver Penciled Hamburg, Seabright Bantams, and game fowls, China Pheasants, Wood Ducks and fowls of various kinds. His houses and coops are built in the most approved style for health and convenience and kept scrupulously clean and comfortable at all seasons of the year.

I was surprised to find in all this region a scarcity of eggs for domestic use. It is strange that so many in the rural districts will depend upon their grocer for eggs, when with a little care and trouble everyone could have a constant supply of nice fresh eggs.

On the 7th of July I was at Lynn, Essex County, and inspected the factory and works of Wood & Page, who build the "Challenge" incubator, one of the popular machines of the day.

I also found in Lynn quite extensive yards of Brahma and Leghorn poultry, the property of Eaton W. Lathrope, esq. Mr. Lathrope has a flock of 800 chickens, hatched in March and April by the above-named incubator, looking remarkably strong and hardy. Egg production is the chief line of business with Mr. Lathrope, and he is well equipped for it.

At Natick are located the yards of I. K. Felch & Son, the senior being one of the first breeders of Light Brahmas in America. Mr. Felch has in his office the mounted skin of a Brahma cock which was hatched from eggs found on board a ship from India in 1847, and the clutch, of which he was one, is believed to be the first Light Brahma hatched in this country. From those imported eggs Mr. Felch raised 8 pullets and this rooster, from the progeny of which he realized over $1,400. Mr. Felch's birds are known the world over as the Felch pedigree strain, and are noted for their distinct markings, uniform type, true Brahma outline and fecundity as egg producers, the hens averaging 160 eggs per year, weighing 1¾ to 2 pounds per dozen. The chicks make broilers, weighing 4 pounds per pair at 8 weeks old. From his long experience in breeding Mr. Felch has brought the Light Brahma to a high degree of excellence. He had 22 chickens hatched in March; at 61 days old they weighed 53 pounds 10 ounces; at 100 days old 107 pounds, and were then sold for $110. Messrs. Felch & Son carry a yearly stock of about 2,000 fowls, consisting of Light Brahmas, Plymouth Rocks, and White Wyandottes.

H. B. May, of Natick, is a poultry man of fifteen years' experience, and a great advocate of incubator hatching. He has 2,500 Plymouth Rocks, all vigorous birds and all hatched by incubator. With 600 eggs Mr. May claims that he can hatch by incubator from 10 to 20 per cent more chicks than by the hen. The trouble with incubator work comes from not knowing how to manage the machine. To obtain and keep the correct degree of moisture is the great secret of success. Different conditions of the atmosphere require different management, and here is where so many fail. Vermin is the great destroyer of young chickens hatched in the natural way; with the incubator rightly managed all this is avoided.

At South Natick I visited the yards of A. F. Hunter, editor of a poultry journal. Mr. Hunter has a variety of stock, Light Brahmas, Golden and Silver Laced Wyandottes, Plymouth Rocks, Black Minorcas, Langshans, and 800 chickens.

Friday, the 15th, at South Framingham I examined the yards of York Bros., who are engaged in raising broilers and roasters. They had already marketed 2,000 chickens the present season, and had then on hand about 2,000 more nearly large enough to kill. Their stock is entirely of the Light Brahma breed. They begin hatching in December. At 4 months old the chicks will weigh about 6 pounds each, the size for roasters, and readily bring 40 cents per pound. Their location is well adapted to the business; houses and yards ample and well kept. The fowl houses are 100 feet long, divided off into rooms 7 by 10 feet. Each room contains some 100 chicks, with a yard adjoining for outdoor exercise. Their feed consists of cracked corn, wheat bran, animal meat, mixed and moistened with water and fed three times a day. Much care and labor are required in managing such an establishment; but I judge from my observation it is made quite profitable under the judicious management of these young and enterprising brothers.

E. Wescotte, of South Framingham, is interested in developing the Black Leghorn fowl, which seems to be growing in favor with many. They are hardy and lay more and larger eggs than any of the other varieties of Leghorn fowls, and require but a small amount of food.

They stand confinement well, and if allowed liberty are good foragers. Mr. Wescotte also has a few Duckwing Leghorns, which, with the general characteristics of the breed, are the most beautiful of the Leghorn family. The cockerel has a silver-laced hackle and saddle, black breast and all under color; flight feathers white with a black bar across the wing, the shoulder a silver color; a very large black tail and is a fine upstanding bird. The pullet has a pretty salmon breast, silver-laced hackle and a steel gray body color.

D. L. Barbour is doing good work in poultry industry at "Maple Farm," near Framingham Center. His establishment is of the highest order, and run with clock-like regularity. Light Brahmas, Buff Cochins, White and Barred Plymouth Rocks are his favorites. At this farm he has some 500 mature fowls and 1,000 chickens. Another farm of his within a few miles is equally well stocked. His fowl houses are heated by hot water, coops nicely whitewashed, floors cemented, and roosts cleaned off thoroughly every morning, leaving no trace of filth or bad odor.

V. B. Prescott has a mixed variety of 200 fowls, Plymouth Rocks predominating for egg production. His 150 hens last year laid 1,800 dozen eggs or 144 eggs per hen.

F. E. Bailey has 500 Plymouth Rocks and Light Brahmas and 1,500 chickens, also a cross of Plymouth Rocks with Brown Leghorn, producing a handsome black fowl and good layer. From 15 hens of this cross he obtained over 300 eggs in December last.

At Saxonville, a manufacturing town 5 miles north of Framingham, I found but little interest taken in poultry; one yard of Plymouth Rocks owned by a Mr. Jones was all the high-grade stock I could find.

At Worcester much interest is displayed in all the higher classes. A. W. Andrews, 2 miles out of the city, has a stock of Dark Brahmas, White and Barred Plymouth Rocks and Black Leghorns. Mr. Andrews is much pleased with the latter. He has been raising this breed for ten years, and thinks them much superior in laying qualities, more hardy and heavier than the White or Brown variety, and stand confinement equally well. He makes it a point to keep a good pure-bred stock for actual use, rather than show. He is well located and equipped for a large and profitable business.

Dr. F. H. Howland and J. B. Bowker are poultrymen within the city. Dr. Howland has been interested in that line thirty years and has tried nearly all the different breeds and finally settled down upon the White Wyandotte as the most satisfactory to him. Mr. Bowker is a young man of twelve years' experience with poultry and declares there is no better breed of fowls in America than the Plymouth Rock. He claims that they attain the highest degree of public favor as soon as they become fully known, and to-day are raised in greater number and are more popular than any other variety. After ten years of careful selection of breeding stock and judicious mating, Mr. Bowker has a strain of good size, with yellow legs and beak, low comb, deep-blue barred plumage and correct shape. At Worcester, January, 1888, in competition with nearly 100 birds, the pick of New England yards, Mr. Bowker's Plymouth Rocks went to the front, winning first, second, and third prizes and all specials on breeding pens. Also grand special prize of two silver cups for best exhibit of Plymouth Rocks. Fifteen birds were exhibited, with an average score of 92 points. Owing to the growth of the city and being pressed for room, Mr. Bowker has just disposed of his entire stock.

There are also several yards of fancy poultry in Worcester. A. H.

Jones has Black, Golden, and Silver Spangled Hamburg, Silver Penciled Hamburg, White, Buff, and Partridge Cochins, Black Spanish, Colored and Silver-gray Dorkings, Black Langshans, Pearl and White Guinea fowls, and several varieties of Bantams.

C. A. Ballou has Partridge Cochins, Dark Brahmas, and Game Bantams.

At Leicester, with Mr. J. H. Woodhead, I found some fine Plymouth Rocks and White Leghorns.

M. M. Morey, in the same village, has yards of Silver and Golden Polish, which are proving excellent layers.

At Lancaster I inspected the yards of A. C. Hawkins, one of the leading Plymouth Rock men of New England. Mr. Hawkins carries a stock of about 2,000 fowls. This season he will raise some 5,000 pullets. His Barred Plymouth Rocks are among the most popular fowls in America to-day. This strain Mr. Hawkins has bred for sixteen years, bringing them to a higher standard each year. They are of a rich blue, deeply and distinctly barred to the skin. They have a peculiar frame, deep full breast, broad back, and legs set well apart, low stiff comb, and rich yellow legs and beak. One hundred dollars was refused for a pullet he bred last season, and $125 was offered him for his best cockerel, "Buffalo Bill 2d." Mr. Hawkins has also some very fine White Wyandotte poultry. The White Wyandotte is a sport from the Silver variety and was originated and first bred by Mr. George H. Towle, of New York State. In 1872 he hatched several true white sports from his laced birds, and the following season bred these white fowls together and found they bred true to form and color. He continued to breed them till 1886, when Mr. Hawkins went to their original home and purchased the entire flock. They have the same size and general characteristic of the Silver Wyandotte, and are favorites with breeders who admire a white fowl. Having no dark pin-feathers they are very desirable for market purposes.

H. C. Lapham, a neighbor of Mr. Hawkins, has 300 mature fowls and 1,000 chickens of the Plymouth Rock breed, and is giving much attention to their improvement. He feeds with great care and regularity, making the needs of his poultry a study. Finely cut lawn grass mixed half and half in bulk with bran, oats, and corn meal scalded, he finds makes an excellent diet for his flock. The fowls will eat every particle with great relish, and it keeps them in excellent condition for eggs or the table.

Mr. Wm. Brown, in the village, has Plymouth Rocks, Light Brahmas, and a cross of Brown Leghorns with Light Brahma hen. The offspring of the latter is a good sized, light colored fowl, with excellent laying qualities and well adapted to general use. Mr. Brown's establishment is throughout a model of neatness and good management.

At Leominster I found a fine lot of poultry, owned by O. J. Putnam, who has had sixteen years' experience with poultry. He prefers the Plymouth Rock above all other breeds. For table use he would choose the white variety as giving a better appearance when dressed, but, for laying, he thinks the Essex strain of Barred Plymouth unexcelled. Mr. Putman has some original ideas in regard to the management of sitting hens. He feeds entirely with whole corn during incubation. By excessive feeding with highly nutritious food he will break up a sitting hen and force her to commence laying in three or four days. By the same process of feeding he can expedite the shedding of feathers and renewing of plumage so that the hen will take up her task of laying within a week.

Mr. Hilston, at North Leominster, and Mr. Wm. Vining, some 4 miles out, are both interested and are doing a good work in the poultry line. The latter has some 600 Light Brahmas, and will add greatly to his present stock as soon as his building accommodations will permit. Returning, on the 25th, I stopped at Ayer Junction to inspect the yards and works of A. A. Fillebrown, located at that village. Mr. Fillebrown is not only a breeder of high-grade poultry, but the inventor of an excellent brooder he calls "The Apollo," a machine to be used in doors or out, and he claims will comfortably brood 100 chickens at a cost of 1¼ cents for twenty-four hours. The machine is simple in construction, durable, and works to a charm. Mr. Fillebrown's "Bay State strain" of White Plymouth Rocks is equal to any I have yet seen.

On the 10th of August I took steamer from Boston direct to Provincetown, at the extreme end of Cape Cod, and spent two days in that vicinity investigating the poultry industry. I was happily disappointed in finding so much interest shown in that branch of agriculture on those barren sands.

Capt. E. Cook has retired from hunting the whale in the north seas and is giving his attention to pure-bred poultry. He has a stock of 150 White Leghorns, Light Brahmas, and Black Minorcas, which he is managing with great care and interest. Capt. Cook's flock is divided into yards of 24 hens each. Yard No. 1, White Leghorns, laid during five months, commencing March 1, 1,485 eggs; yard No. 2, Plymouth Rocks, 1,450 eggs; yard No. 3, Black Minorcas, 1,057; yard No. 4, mixed lot, 1,041; making a total of 5,033 eggs. From 84 hens within six months he obtained 9,167 eggs, being 109 eggs from each hen in one hundred and eighty days. He feeds with stale bread from the city bakery. The bread is soaked over night, then mixed with scalded wheat bran, and fed morning and evening. Hard grain is given at noon.

B. O. Groce has 200 White Leghorns, and a Mr. Freeman a lot of mixed breeds. The latter finds it profitable to ship his eggs to Boston.

Mr. Henry Pierce is located among the sand hills and has a fine lot of poultry, superior to any other I saw in the place. Mr. Pierce, not content with a sandy foundation, leveled a space some 10 rods square between the hillocks and covered it several inches deep with ashes and other material, making a surface hard and dry. Here he built his house, barn, and poultry house, To this good foundation, free from sand, I attribute in a great measure the superiority of his birds. All through the sandy region I noticed a marked inferiority in the appearance of the poultry. The sunshine reflected from the hot, dry sand seemed to take the life and beauty out of poultry.

At Wellfleet, some 20 miles up the cape, is located "Duck Creek Poultry Yard," E. I. Nye, proprietor. He has 300 very fine Pekin ducks. These grounds are on a southern slope reaching down to a creek and salt marsh, to which the ducks have free access at all times. Mr. Nye makes a specialty of eggs for hatching, and he contends that good vigorous eggs can not be obtained of ducks kept from their natural element. Duck eggs may be had in great numbers under other conditions, but they will lack vitality, and the stock hatched from them will be inferior. Mr. Nye sends his eggs to all sections and has a ready sale for all he can produce at $6 per 100. Each duck yields him about 100 eggs in a year.

At Barnstable and Hyannis I found some interest. Mr. C. H. Walloy, of the latter town, has 150 good-looking fowls located on a favorable spot, a high gravelly knoll, with grass and shade trees and the sea breezes always about them. His hens averaged 104 eggs each the past year. I found no one at Barnstable interested in the higher classes. Nearly every family has its little flock of domestic fowls for home use. If any overplus is on hand a ready market is found at the various summer resorts in this vicinity. A dealer, who makes a business of collecting poultry of the farmers in this neighborhood, informed me that he sells $300 worth weekly to one house at Oyster Bay. The soil in this vicinity is more substantial and the poultry much better than far on the extremity of the cape.

L. C. Eldred, at Sandwich, is trying to do something at poultry and cranberry culture combined. He has 200 Plymouth Rocks and Light Brahmas, with geese, ducks, and turkeys—too much of an undertaking for one pair of hands, as indicated by the condition of his stock and yards.

Mrs. Burgess is much interested in her little yard of Golden Spangled Polands. She thinks them far superior to the Leghorn in egg production, laying a larger, richer egg. The fowls are very domestic and easily confined within their limits.

At Buzzards Bay I called on A. E. Booth, and others interested in poultry. Mr. Booth is chiefly devoted to pigeons and has some 400 at present, including Antwerps, Magpies, Carriers, Bald-Head Trumpeters, and Red Tumblers.

Mr. Henry Perry has a stock of 600 fowls, young and old, and of every shade and condition, all indicating a lack of care and interest.

Capt. C. C. Butler is intelligently breeding Buff and Partridge Cochins with good success.

At Middleboro I found the poultry stock much improved. Plymouth Rock and Light Brahma are the favorites here.

Mr. J. Armstrong has a fine lot, and will greatly enlarge his yards, when established on his farm at South Sandwich, another season.

Mr. Charles Morse is dealing in poultry for the city markets. His trade averages 2,000 pounds weekly for eight months of the year, commencing in March. Prices range from 20 to 30 cents per pound for chickens, about 10 cents per pound for fowls, 50 cents each for ducks, and $1 for geese. Mr. Morse collects from all sections of the country roundabout, and sells chiefly in the Boston market. Another gentleman in Middleboro, I am informed, is engaged in the same line of business and to about the same extent.

At Plymouth I spent several days looking after the poultry industry in that ancient town and neighborhood.

Col. B. F. Goddard, an enterprising farmer, has a well-equipped establishment and is doing good work in breeding Plymouth Rocks and Light Brahmas. Last year Col. Goddard raised 2,940 chickens, and might have had a still larger number this season were it not for an attack of illness at the time the work needed his personal attention. He keeps an accurate account of expenses relating to his poultry, and he knows the business will pay a good profit when rightly managed.

Mr. Franklin Goddard, a gentleman of 76, and uncle of the last named, has Irish Game and Plymouth Rocks. Mr. Goddard is an active, intelligent old gentleman and a man of ideas. He has a theory that fowls should be kept in cool, comfortable houses through the hot summer months, supplied with green grass and all necessary food and drink. He acts upon this plan with his own, and is confident he gets more eggs and the fowls are in a much better condition than when allowed to roam at large in the hot sun and burrow in the scorching sand.

Mr. T. Faunce, a one-armed man, located among the hills, some distance from town, has 400 Plymouth Rocks and Light Brahmas. Eight years ago he started his establishment without a penny of his own; now he has a house, barn, and a hundred feet or more of chicken house, all built with his single right hand. Before he ever saw an incubator he constructed one that worked successfully, and he now uses only those of his own make, which will hatch him 90 per cent of fertile eggs. The present year, from 52 eggs he obtained 45 good, strong, healthy turkeys. Mr. Faunce's incubator has no automatic regulator or patent egg-turner. As fertile eggs develop heat of themselves rapidly after ten days, they require airing and change as well as heat and moisture. This he contends can be done better by hand than by any mechanical operation and requires no more night work or care. With intelligence and good judgment nearly every incubator in the market can be run with success; without them failure is sure with the best that can be had, says Mr. Faunce.

Young Frank Holmes is well located and has 150 very fine birds, but is disheartened by the results of his incubator hatch this spring, having only 50 chickens from 300 eggs. He will give up poultry-raising and try his hand at some occupation requiring less care.

At Kingston, a neighboring village, E. A. Holmes has a well-regulated poultry establishment, with all the modern improvements for heating and feeding. For the past few years duck-raising has occupied his attention chiefly in the line of poultry. This year he has been very unfortunate in his hatch, nearly 90 per cent of his eggs proving worthless. He attributes this to the breeding in-and-in of his stock, and will make a thorough change before another season.

In September I visited Troy, N. Y. Finding little of interest here, I went on to Ballston. At that place were a number interested in pure-bred poultry and several yards of good stock.

Mr. O. E. York has a fine showing of Buff Cochins. This breed is prized for good laying qualities, excellent flesh, and quiet, gentle disposition.

Mr. Joseph Richardson, of this town, is doing good work in the poultry industry. His hennery is a model of neatness and order. The internal arrangement is such that the feeding, watering, and nearly the whole care of the fowls are regulated by clockwork. At the appointed time a bell is rung to call the flock, the doors open, and grain scattered by a revolving wheel sufficient for one feed. Says Mr. Richardson:

> The first thing I usually do on entering my fowl house in the morning is to look at my clock to see that it is running, and know that my fowls will be fed just so much at the hours desired during the day. Then I see they will not be wanting for water in the fountain, from which all get their drink in different yards.

Over the doorway and upon the walls are painted mottoes and reminders, something as follows: "Don't over-feed," "Ventilate well," "Give fresh water," "Sweep out daily," "Look out for mites," "Give green food," "Fumigate often," "Watch for disease," "Feed regular," "Give bone and shell," "Essential sunlight," "Keep from drafts," "Whitewash often," "Shelter from storm," "Look after dust-boxes," etc. Mr. Richardson's rule has been "If but a little labor is done each day, have a method to its results and then do it invariably." This is the secret of his success. Fifteen years ago he became an invalid and was obliged to give up a mercantile business and seek an outdoor life. As most available he turned his attention to poultry. Little by little he increased his flock and enlarged his buildings. Feeble in health, he was obliged to work slowly, but with method and persistence he has accomplished wonders, and now has one of the best-equipped poultry establishments in the State, all the work of his own hands and brain.

At Saratoga I visited the yards of Eddy & Son, breeders of Bradly strain Plymouth Rocks, J. E. Hazard strain of Silver Spangled Hamburgs, and Forsyth strain of Single Comb Brown Leghorns. All took premiums at the late fair.

I also visited the extensive yards of Judge Hilton at Woodlawn Park and inspected his stock of pure-bred Light Brahmas, Buff Cochins, Golden, Silver Laced, and White Wyandottes, White and Brown Leghorns, Indian Game, and six or eight varieties of bantams; also geese, turkeys, and ducks of excellent flesh and feathers. I was unfortunate, however, in the day of my visit, as the choicest of his birds were on exhibition at the State fair at Syracuse. The present season they raised about 2,000 chicks, all hatched by incubator, using two of the "Perfect Hatcher," one "Pineland," and one "Prairie State," all good machines, yielding from 50 to 75 per cent chicks from the eggs set.

September 12 I was present at the Washington County fair at Sandy Hill. The display of poultry here was rather meager; J. W. Refenberg had a good showing of Plymouth Rocks, and there were several coops of choice Light Brahmas. Also Dr. Thomas, of Glens Falls, exhibited a fine lot of Indian Game. Bantams predominated in the show. Of this little bird there were twenty coops of every feather.

At Dr. Thomas' yards in Glens Falls I saw some good stock of Plymouth Rock, Brown Leghorns, and Indian Game. The latter breed seems to be growing in favor among all breeders in this section.

Plattsburg was reached on the 14th, just in season for the Clinton County fair. The exhibition hall here was well stocked with bantams and game fowls, but the useful breeds were not so plenty. There was a limited display of Plymouth Rocks, Black Minorcas, and Brown Leghorns of very good quality, and some fine geese, ducks, and turkeys.

At Champlain Mr. Fletcher Murray is raising a splendid lot of Partridge Cochins. Mr. Murray has been interested in poultry a number of years, and has tried several breeds of improved stock, but none pleases him so well as the Partridge Cochin. Good layers, superior flesh, very domestic, quiet and easily confined; in fact, scarcely require any fence to keep them from mischief, as they are nonscratchers. His flock has had free range about the grounds the entire summer, and has not troubled his garden, though unprotected by fence and near at hand. Ducks are quite extensively raised in this section, and I found a goodly number of barnyard fowls along this border line.

There were imported from Canada and entered at the custom-house of the district of Champlain during the year ending June 30, 1892, 13,395 dozen eggs; value, $2,137.82; duty, $669.75; live poultry, 34,493 pounds; value, $2,452.77; duty, $1,034.79. Dressed poultry is classed with other meats and it is therefore difficult to obtain the actual amount imported, but I was informed it was quite considerable at certain seasons of the year. The district of Champlain extends from Rouses Point, New York, westward about 100 miles to Hogansburg on the St. Lawrence River.

At the New York and New England Agricultural and Industrial Fair, held in Albany, I found a good collection of poultry, useful and ornamental. There were over 900 entries and $1,200 offered in prizes. All the improved breeds were well represented. Of Brahmas there were 31 entries, Cochins 57, Langshans 6, Dorkings 12, Dominique 10, Plymouth Rocks 52, Wyandottes 57, Javas 17, Hamburgs 87, Black

Spanish 10, Leghorns 96, Minorcas 42, Houdans 11, Polish 26. Of game birds there were 69 entries. The Indian Game predominated, there being 39 entries of this fine fowl. There were over 200 entries of bantams, game, and ornamental, 20 of turkeys, 8 of geese, and 17 of ducks. Some very fine Bronze turkeys and Pekin ducks from Woodlawn poultry yards, Saratoga Springs, were well worthy of note. The whole exhibit of poultry at this fair was very good, indicating a marked interest in this branch of agriculture in the Hudson River Valley and its neighborhood.

I left Beverly, Mass., on the 12th of October for a tour of observation through Vermont and New Hampshire, and arrived at Bellows Falls, Vt., the same evening. Here I called on Mr. A. A. Haliday, a very successful breeder of Black Langshans, and owner of the noted hen "Princess" of that breed. The hen is now 9 years old, and has never been beaten in any poultry exhibition. Her fame is far and wide, as the most perfect scorer of her kind. Mr. Haliday has been offered $200 for "Princess," and $300 for her with two pullets of the same strain. After fifteen years of experience with nearly all the improved breeds of poultry Mr. Haliday is satisfied with the Langshans as a breed for general purposes.

Mr. A. E. Lamb, of this town, is also a great admirer of the Langshans, of which he has a large flock in excellent condition.

At Rutland, Vt., I found little interest in poultry. The late Mr. R. C. Bowen had started quite an extensive establishment, well equipped and stocked with some 500 fowls; but his decease put a stop to his plans a year ago. His buildings were well constructed and arranged, but are now left unoccupied and for sale.

Mr. G. Mellington was somewhat interested with Mr. Bowen in his enterprise, and is a great admirer of the Wyandotte, which he bred extensively some years ago at Bennington, Vt. In regard to this fowl he says: "Of the many breeds the Wyandotte stands preëminently popular, and has attained this popularity entirely by its intrinsic merits." Prior to 1883 they were called Silver Laced Eurekas, Columbia, American Seabrights, etc. By the latter name they were presented to the American Poultry Association, but the committee reported unfavorably, on account of the name. The objections were, that this name would be confounded with a tribe of bantams bearing the name of Seabrights. The Wyandottes are a cross between the Silver Spangled Hamburgs and Dark Brahmas, and are supposed to have originated in Onondaga County, N. Y.

At Burlington, Vt., I found a number interested in developing the higher grades and doing what they could to interest and encourage the people in poultry culture.

Mr. Frank Perkins is an admirer of Plymouth Rocks, and has well-kept yards of them.

Young Mr. Sutton has some fine White Leghorns and Polish fowls, which he is caring for with interest.

C. F. Wheeler, the postmaster of the town, is interested in Plymouth Rocks, of which he has a fine showing. Mr. Wheeler thinks wheat is the best of all feed for poultry, and soaked oats excellent for growing chickens, giving them muscle and strength.

B. B. Beeman is interested in the promotion of poultry industry and is stirring up the people of Vermont to the importance of this branch of husbandry. He has a large flock of Plymouth Rocks and other varieties. Took first premium on Barred Plymouth Rock fowls and chicks; Black Rose-comb Bantam, chicks; Silver Seabright Bantam fowls and chicks; second on Barred Plymouth Rock chicks, and special premium on best exhibit of Barred Plymouth Rocks.

J. W. Jones has a good collection of pure-bred fowls. He took at the last exhibit first premium on Light Brahma fowls and chicks; Buff Cochin fowls and chicks, Partridge Cochin fowls and chicks, Silver Gray Dorkings and chicks, Black Minorca chicks; first and second on Buff Pekin Bantam fowls and chicks.

S. L. Lord has White and Silver Laced Wyandottes and Golden Spangled Hamburgs. He is alive to the poultry industry and now organizing a State poultry association in Vermont.

F. W. Booth, at Essex Junction, is a dealer in eggs. During the past year he has handled over 120,000 dozen. He collects from the farmers in the northern section of the State and ships chiefly to Boston.

There were imported into the district of Vermont from Canada during the fiscal year ended June 30, 1892:

Articles.	Quantity.	Value.
Eggs .... dozen..	140,610	$20,482
Poultry:		
Alive .... pounds..	68,293	4,424
Dressed .... do...	19,148	1,455

At St. Albans, on the 18th, I visited the Governor Smith farm and poultry yards. Here I found good buildings and accommodations for 500 or 600 poultry, but since the death of the governor the glory has departed. A few scaly fowls are left, but all poorly cared for.

N. C. Smith, a brother of the late governor, still lives. His place is under the supervision of Mr. Lapoint, an intelligent, energetic Frenchman. They have over 300 Light Brahmas and Wyandottes, all in fine order. The houses and yards are large and airy, are cleaned out thoroughly every morning, and everything about the place has the mark of neatness and good management. On my way north from St. Albans I made a stop of a few hours at Richford, Vt., and inspected the yards of H. M. Goff, Carl Smith, and B. R. Fuller, all doing well with Plymouth Rocks and Indian Games.

At Newport, Vt., Mr. E. H. Norris and his son, a very intelligent young man, are making preparations for an extensive hennery. They are working with caution, both understanding the good points of a fowl and how to manage the business with success. Their present stock consists of Plymouth Rocks and Brown Leghorns; the former they prefer for general use. An accurate account is kept of all expenses, and they know just what each bird costs them and the income. From 39 hens last year they cleared $2.10 per hen—eggs averaged them 22 cents per dozen. All feed was bought at market prices, except the scraps from the family table, which they offset with the eggs used for family purposes. For egg production Mr. Norris prefers a cross of breeds to the pure blood, and with proper management he is confident a paying business can be had with poultry, even in this remote section of the State.

On Thursday, October 20, I was at St. Johnsbury, Vt., and spent five days. Here and at Waterford I found some interest developing and some good stock. At Hill Top farm, 2 miles out, Mr. W. L. Swett has a large collection of Plymouth Rocks, Leghorns, Wyandottes, Red-Caps, and several varieties of Bantams, also geese, ducks, and turkeys.

Mr. Swett has taken several prizes at the late fairs and is introducing his thoroughbred stock through this section of the country.

Mr. George Moore has a very superior lot of Plymouth Rocks and Black Minorcas and is supplying his neighbors and the public with good stock.

C. Boynton is interested in good poultry, and is doing what he can to develop this industry.

Mr. B. C. Graves, at Waterford, a neighboring town, is raising a good stock of Plymouth Rocks, Light Brahmas, Partridge Cochins, and Wyandottes. His birds are all well kept, and grown chiefly for prize winning at the agricultural fairs.

Returning southward on the 24th I made a stop of one day at North Conway, N. H. Mr. John Riley, of this town, is raising a good stock of Plymouth Rocks and is making arrangements for a large business in broilers and egg production. Mr. Riley is an inventor; his incubator is of his own construction, regulated by electric battery, and works very satisfactorily, hatching 85 per cent of eggs set. Mr. Riley is confident of a good home market at remunerative prices for all he can raise; broilers and roasters here at his door sell at 30 and 40 cents per pound, and eggs 30 cents per dozen.

At the Bigelow farm I found a well-constructed and very convenient poultry house to accommodate some 500 or 600 fowls, but the proprietor, Mr. E. B. Bigelow, died recently, leaving his hens and his cattle to uninterested hands, and there is little of interest at this once finely equipped establishment.

Henry Hayford and D. E. Tower, two young and enterprising men, are awake to the interest of home production of poultry and eggs, and will enter largely into the business the coming season. They each have a fine stock of well-bred Plymouth Rocks on hand. Mr. Hayford from his hens realized $2 per head annually, and Mr. Tower, from 52 hens and 80 pullets, since January 1, 1892, has sold in poultry and eggs to the amount of $125, and has his flock of pullets left for another season.

I am informed that nearly all the poultry and eggs used at the various hotels among these mountains are shipped by express from Boston, as the poultry supply is very limited throughout this section. A very promising opening awaits any one who will step in and fill the demand for fresh eggs and broilers for the thousands who resort here for their summer rest.

During the month of November I made a second visit to several establishments in the vicinity of Beverly, Mass., in order to see what progress had been developed in this branch of industry the past year.

Mr. E. Foster is having fair success with his flock of 400 fowls. He had a fine showing of eggs during the summer, but at present his hens have nearly suspended operations in that direction.

Mr. John Marshall is pleased with his year's work. His cross of Light Brahma cock and Brown Leghorn hen has proved very satisfactory, producing a good sized buff-colored hen, an excellent layer.

F. W. Bachelder, at Wenham, continues his well-equipped establishment with some 300 fowls of the improved varieties. The young man now in charge is much interested in his work, and proposes to use every effort to outdo his predecessor, who had not made a great success of the enterprise.

E. H. Durgin has a flock of 200 very fine Plymouth Rocks. From 140 hens in eight months ending in December he obtained 10,612 eggs. From the 1st of January, 1892, to the 16th of November, they had laid 13,000 eggs. During last July and August the sale of eggs from his

140 hens paid for their keeping and that of his horse and left him a cash balance of $42.

Mr. G. Dugan, at North Beverly, has a mixed lot of 300, embracing all sorts and sizes. Little care is bestowed or interest felt, and no profit realized. Mr. Dugan is anxious to sell, that he may devote his whole attention to his business in the city.

D. G. Marshall, of the same village, has 500 cross-bred fowls, and is making them profitable. He prefers a mixture of the improved breeds for eggs, rather than a pure-blooded stock. His entire flock runs at large in a body, and is fed chiefly with corn at night, and scalded bran with an addition of one-third of corn meal in the morning. Mr. Marshall keeps up his stock by introducing a pure blooded cock every season. During the past year his hens have yielded him a profit of $1.50 per head above expenses, and he thinks he can do even better in future.

Mr. J. K. Hopper is a successful poultry man at Danvers. His flock of 800 is composed of Plymouth Rocks, Light Brahmas, Leghorns, and Buff Cochins. Mr. Hopper has been in the business some three years, and understands how to make poultry-raising profitable. He operates two incubators and his average hatch is two-thirds of the eggs set. Corn and wheat compose his evening feed, and scalded bran and corn meal that for morning. Mr. Hopper keeps no book account of his business, but pays all bills as they come in, and is now putting up a good substantial 100-foot brooder house with the poultry money he has to spare after his season's work.

Lincoln Ames, of the same town, has a fine flock of 300 Light Brahmas, all paying well for the care and expense of keeping.

At Wenham, Mr. S. G. Currier has as fine a lot of Plymouth Rocks as I have yet seen. He understands the secret of poultry-raising for profit, and is supporting his family by the profits of a flock of 150 laying hens. He keeps only young stock; says it is not profitable to keep a hen more than two winters, and he usually kills his off the second year. Mr. Currier feeds with no particular food, but gives a variety, including a liberal supply of corn.

Mrs. George Dodge, at Hamilton, has a profitable lot of 125 cross-bred poultry, which yielded her the past year $1.60 profit per head. Mrs. Dodge prefers scalded oats and wheat for laying hens, and keeps only young stock for that purpose.

Baker Brothers, at Manchester-by-the-Sea, have sold out their flock of mixed breeds, and propose to start anew with pure-blooded Plymouth Rocks and greatly enlarge their establishment.

Several others in this town are turning their attention to poultry culture and egg production. They have a ready market at their door, and a good demand for broilers and fresh eggs.

Mr. G. P. Low, proprietor of the Essex poultry yards, at South Essex, still conducts his work with success. His Silver-laced Wyandottes are of the Hull and Hondlettes strain. His breeds from four pens of this variety, composed of very fine birds, possessing bright red ear lobes and finely shaped double comb of standard size, bright yellow legs, and black tails, wings, breast, and hackle of almost perfect markings, showing bars and lacing very distinctly. He also has a nice lot of White Wyandottes, a breed which is becoming quite popular. Mr. Low also has Light Brahmas, Plymouth Rocks, and several varieties of the Leghorn. His Black Leghorn, he thinks, can not be excelled for beauty and egg production. The pullets begin to lay when 4 months old and keep it up through the season. His strain is from Mr. Wilson, the original introducer of this breed. I was much pleased with Mr. Low's poultry house and yards. In front, which is the sunny side of his 200-foot house, is what may be termed a "sun parlor," a glass inclosure for winter use. Each division in the house has an independent passageway to this warm retreat during the cold season, and also with the large shady yard in the rear for summer and milder days. This whole establishment is well managed, every room is kept thoroughly cleaned and comfortable, and the birds give good evidence of the care and attention bestowed upon them.

At Brockton and neighboring towns in Bristol County, I found a lively interest in the breeding of thoroughbred fowls, particularly Plymouth Rocks and Light Brahmas. I was at Brockton in time to attend the third exhibition of the Brockton Poultry Association, which opened in that city on the 7th. There was a fine display of high-bred birds; reported the best exhibition the association has yet held. The Light Brahmas were represented by 39 coops; Barred Plymouth Rocks, 28 coops; White Plymouth Rock, 9 coops; Buff Cochins, 11 coops; Black Cochins, 16 coops; Partridge Cochins, 18 coops; White Cochins, 14 coops; White Leghorns, 12 coops; Black Leghorns, 9 coops; Black Javas, 12 coops; Black Langshans, 6 coops; Laced Wyandottes, 13 coops; White Wyandottes, 6 coops; Indian Game, 11 coops; Bantams, in great variety, 54 coops. There was a liberal display of pigeons and the number of varieties was exceptionally large. Among the exhibits were six English Carrier pigeons exhibited by A. D. Leonard, of Mansfield, who also contributed a cage of Fantails of different colors. J. B. Holmes, of Kingston, had 26 varieties; J. T. Conby & Co. had a goodly number of Tumblers and Pouters. Of fowls, A. L. Willis had a large and very fine display of Light Brahmas; and a pen of Cornish Indian Game, the property of J. E. Perkins, Stoughton. Some Black Spanish fowls sent by John Turner, Methuen, attracted much attention.

Round about Brockton I found many interested poultry people, and a good showing of excellent birds. Fremont Willis has Light Brahmas, Plymouth Rocks, and White Wyandottes. His cross of Wyandotte cock with Light Brahma and Plymouth Rock hen is proving very satisfactory. Mr. Willis keeps up the vigor of his stock by changing his male bird every second year; he prefers this to a change every season. J. W. Shaw is a fancy breeder of Light Brahmas; he has a rooster valued at $75, a half-interest in which he has just disposed of for $37.50 in cash.

Mrs. Caroline Porter is devoting her efforts to poultry culture of the finer sort. Her stock consists of Black and Brown Leghorns, Buff and Black Cochins, and Black Japanese fowls. The latter is her favorite, both for eggs and general use. Mrs. Porter makes a point of raising only pure-blooded stock of the highest grade; she attends personally to her poultry, and knows that everything is done with decency and in order.

Mr. Joseph Perry is doing what he can to bring out the finer points of the Light Brahma and to gain prizes at the poultry show. Eggs for the market are secondary considerations. He has some fine birds, scoring 91 points at the late exhibition.

Young Frank Hall and A. L. Willis are raising fancy stock of White Plymouth Rocks and Light Brahmas; both took high prizes at the show.

At Randolph, Mr. J. C. Buck and Manley Clark are showmen of fancy Brahmas, with well-arranged houses and yards.

J. L. Tillson, at Whitman, has some 200 laying hens of mixed varieties, and makes a paying business with his eggs and broilers; of the latter, he sold 1,200 the present year.

S. P. Gernsey and E. F. Benson have White Leghorns and Plymouth Rocks of good showing, both striving for the prizes at the exhibitions.

Returning from Brockton on the 14th, I spent a few hours at South Easton to inspect the noted duck yards of James Rankin, located some 2 miles from that village. Mr. Rankin now has about 800 ducks in stock for breeding purposes, and raises each year from 7,000 to 10,000. His ducks never see water, only for drinking. They are confined in yards 24 by 100 feet, some 40 in each yard, 24 feet being the size of the pen, within the breeding house. The ducks remain in these yards for nine months, or until August 1, when they are removed in order that the land may be disinfected. This is done by plowing and growing a crop of barley or rye, after which the land is ready for the ducks again. Mr. Rankin thinks free range unnecessary. In order to test his theory one spring he had 10 breeding yards devoted to ducks. One flock of 50 was allowed the range of a 5-acre lot in addition to its own yard. They ranged in common with the cows, and plenty of grass. Another lot of 75 was allowed the range of the whole premises, with the same feed and care as the eight yards confined. The latter were liberally supplied with all the green and vegetable food needed. The egg production and the fertility of each were carefully noted. The difference was very little, and that in favor of the birds confined. Mr. Rankin feeds during the autumn and early winter months twice each day with equal quantities of corn meal, wheat bran, and boiled turnips and potatoes, with about 10 per cent of ground beef scraps. At noon he gives a small amount of dry food composed of equal quantities of cracked corn, oats, and wheat. When the birds commence laying, as they will in December or January, he gradually increases the quantity of meal and animal food, proportionately decreasing the amount of bran. The Pekin duck is Mr. Rankin's favorite; in fact, he raises no other. He prefers this breed for their great size, rapidity of growth, and their white feathers and down, the latter of which readily commands from 40 to 50 cents per pound. They mature earlier, begin to lay sooner, and are more hardy and domestic, and require less water than any other breed. Besides his ducks, Mr. Rankin has some 400 or 500 Light Brahma fowls which he is raising to good advantage.

Mr. Luther Howard, a neighbor, has 150 Light Brahma poultry, valued by him particularly for their early chickens and quiet disposition. He thinks the highly perfected fine-feathered fowl is not always the best for general use. Too much breeding-in-and-in, to bring out the fancy points, is detrimental to the healthful growth and development of a really useful bird.

On the 16th of November I visited Newburyport and spent a few days with the poultry people in that section. Mr. Silloway, of this town, is a breeder of Partridge Cochins, and has been a dealer in poultry for thirty years, buying and selling for the city market 4,000 or more annually. Of late years his trade has fallen off two-thirds, owing to the western supply.

Miss Flora Piper is an enthusiast on poultry and poultry culture, breeding Plymouth Rocks, Dark Brahmas, Buff and Partridge Cochins. The Partridge Cochins she thinks excel all other breeds in egg production, taking the year through, laying at the season of the year when eggs are high, if bred to that end, as she understands how to do. Her pullets begin to lay in September, when 6 months old, and continue through the winter. In a pen of 12, 3 laid 33 eggs in thirty-three days. Her flock averages a profit of $1.83 each, above all expenses yearly, and she is confident of making it $2 per hen in the near future. A careful account is kept and she knows whereof she speaks. Miss Piper has been interested in poultry some six years, and is making a thorough study of the art in every particular.

Mrs. Ellen Grakin has a flock of 200 Plymouth Rocks of pure blood and superior strain. Besides a good supply of eggs she raised 500 broilers this season.

Mr. J. D. King is interested in the Brown Leghorn. His accommodations are of the best, and his birds very fine, bringing him several prizes at the fair this year.

C. B. Sawyer, at Amesbury, is breeding Silver-laced Wyandottes and Black Minorcas. The Minorcas he prefers as being good layers, commencing that duty three weeks sooner than most breeds, and they are a very compact fine-fleshed bird for table use.

My work during the month of January, 1893, was confined to the southeastern section of Massachusetts around Taunton, New Bedford, and Fall River. Throughout this section there is much interest in the poultry industry, particularly in developing the finer points of the pure bred fowl.

At Oak Farm, 2 miles from the city of Taunton, the Sharp Brothers have a fine establishment stocked with Buff Cochins and Light Brahmas, all of high order and held at prices ranging from $5 to $100 each for males. They now have some 200 head out of about 800 raised the present season. Their birds are confined in comfortable houses without yards, and fed once a day with cut clover, steeped and mixed with bran and corn meal; whole corn is kept before them at all times. This manner of feeding and treatment is for fine feather and exhibition rather than eggs and domestic use. Incubators are used for hatching, or rather partial hatching, as follows: The eggs are put in the incubator for ten days, then under a hen to remain till a day before hatching, when they are again changed to the incubator and remain till the chicks are out of the shell, when they are given to the hen for brooding and care. This manner of treatment is thought to be of great advantage to the health and growth of the chickens. Mr. Sharp informed me that their profits on the sale of stock and premiums will amount to over $1,000 the current year.

Philander Williams, of this town, is a specialist in thoroughbred poultry. He says there is a fascination about the business that has led him for twenty-five years to spend all his available time and study in mating, with a view to produce the best possible results. Light and Dark Brahmas and Partridge Cochins are his special favorites. In addition, he has Barred Plymouth Rock, Silver Laced Wyandotte, Indian Game, Buff Pekin, and Gold Laced Seabright Bantams. His Light Brahmas are the "Autocrat" strain, which originated with him twenty-five years ago, large size, good form, excellent layers, and not inclined to sit. His Dark Brahmas are the "Black Prince" strain, imported from Europe several years ago. His Barred Plymouth Rocks were originally of the Drake strain, the stock of which he purchased entire after Mr. Drake's death. By culture and mating they have been much improved in size, shape, and plumage. His Partridge Cochins are from stock imported by himself twenty years ago, and their blood is the foundation of a very popular strain.

Walter C. Bayliss, esq., is starting extensive yards of Partridge Cochins. His flock of 200 now on hand is a fine lot of birds. He will add thereto, enlarge his establishment, and make a business of raising first-class stock of this popular breed.

At the old town of Dighton, C. Waldrum is raising some fine Black Langshans. He prefers this breed to the Plymouth Rock, which he formerly kept, regarding them as more hardy and equally good for flesh and winter laying.

E. W. Turner, of the same town, is extensively engaged in egg production and growing spring broilers. His stock is of mixed varieties, but yield a profit.

On the 17th, I attended the Massachusetts Southern Poultry Association exhibit at New Bedford. This exhibition was very creditable; said to be the best yet held. There were over 250 entries of standard fowls and pets. Plymouth Rocks and Light Brahmas were chief among the former. There were 43 entries of Bantams, and 60 of pigeons.

There is some fine stock in and around New Bedford and a number of highly interested parties. W. C. Farwell is cultivating the Buff Cochins; S. F. Bennett, Light Brahmas; A. L. Grennell, Dark Brahmas, and I. C. Hall, Plymouth Rocks. These seem to be the favorite breeds here, and great care is taken to develop them to perfection.

January 20, I went to Fall River and spent four days visiting the various yards in that city and suburbs. I met here Mr. W. P. Shepard, a poultry man of long experience, and inventor of the Aridus incubator. Mr. Shepard kindly took me to several of the poultry establishments in this section, and I found much of interest and encouragement.

Mr. John Midwood is one of the successful poultry men of the place. He has about 400 laying hens, and nearly 500 chicks. His favorite breed is the Rhode Island Red. From long experience he finds them hardier than the Plymouth Rock, and equally as good for egg production as the Leghorns. Mr. Midwood keeps his poultry confined in warm, well-ventilated houses, with no yard or outdoor life during the winter. He feeds liberally with ground bone, paying little attention to gravel or green food, as he thinks the bone answers for both. Uses little corn, but a good supply of oats, barley, and bran. His fowls look well, and seem to be in the best condition. Mr. Midwood is an Englishman by birth, came to this country twenty-seven years ago to work in a cotton-mill. Twelve years since his health failed, and he was obliged to seek outdoor life. He procured a few hens and sold eggs to the mill operatives. His success encouraged him, and he ventured to borrow $700 with which to enlarge his stock and build more comfortable quarters for his family and flock. He now has a good house and barn, his poultry provided with comfortable buildings heated by steam, and he owes no man a dollar.

Mr. Charles F. Beane, a former superintendent of mills here, who from failing health was obliged to change his business, turned his attention to poultry and is quite successful. He has Plymouth Rocks, Light Brahmas, and Buff Wyandottes. The latter breed he prefers above all others for general use. He feeds liberally with ground bone, but thinks gravel must be provided to assure permanent health and vigor. In fact he takes great care to collect and house a good supply of this material for winter use, and mixes a small quantity with the soft food for two meals daily. He has an incubator of his own make that is hatching 75 per cent of fertile eggs at the present time. His establishment is heated by steam, with which he also runs an engine for grinding bone and propelling the machinery of his workshop.

R. G. Buffinton is an old and experienced breeder of thoroughbred poultry. Buff Cochins, White and Buff Leghorns, Rhode Island Reds, and Pekin Bantams are among his stock. He has some 600 now on hand, with good accommodations, and he is very successful in gaining premiums at the exhibitions.

D. P. Shove, near by, is interested in Houdans and Buff Wyandottes, the latter being the product of a cross of Wyandotte with Rhode Island Red. The original Rhode Island Red, I am informed, is an old stand-by in the State of Rhode Island. It is a single-comb, reddish buff fowl, hardy and very prolific in eggs. When it is crossed with the Silver-laced Wyandotte, a very handsome rose comb, good sized, buff colored bird is produced and is called Buff Wyandotte. They are general favorites throughout this section, and highly spoken of by all who have given them a trial, both for eggs and table use.

I have mentioned the Aridus incubator, invented and manufactured by W. P. Shepard, at Fall River. This incubator is built and operated on the dry-air principle, as the name indicates. The question of moisture has been one of the most difficult which incubator manufacturers have had to encounter. Mr. Shepard thinks the Aridus has settled the question, as this machine is doing good work without moisture. It will hatch strong chickens and a large proportion of them. Mr. Shepard has been studying nature's methods with a view to produce natural results. He says that the glossed appearance, which was formerly supposed the hen gave the eggs by mechanical means, is in fact the result of chemical action, and is always present if the natural process of incubation is not interfered with, and is a part of the process by which the calcareous matter necessary for forming the bones of the chick is made ready to be taken up by the vessels of the allantois which convey it to the framework of the rapidly growing embryo. If this process is interfered with, the result is the production of a chicken which will be in the condition of a rickety child, weak and deformed. If there is moisture in the egg chamber during the period of incubation, this process is interfered with. If the water is in great quantity the process is almost entirely suspended, resulting in the hatching of feeble chicks, when they are able to get out of the shell at all. The Aridus is regulated by the application of the principle of an air thermostat placed in the egg chamber, so that the regulation is taken from the effect rather than from the source of heat, thereby counteracting the outside changes of temperature, which is not the case when the regulation is taken from the source of heat. By this method of regulation the heat in the egg chamber can be kept, if required, as low as the outside temperature without changing the flame of the lamp in the least.

On the 8th of February, 1893, I began a tour of inspection through western Massachusetts and Connecticut, making my first stop at Springfield. The severe weather and deep snow have been great obstacles to a thorough inspection of the territory through which I passed.

At Springfield I visited the finely equipped establishment of S. J. Gordon, esq., who makes a specialty of raising Dark Brahmas. His accommodations are of the best, houses all heated by steam, well ventilated, and thoroughly clean. The poultry are fed in the morning with broken crackers from the bakery, mixed with corn meal and vegetables well scalded the night before. For evening he gives cracked corn and whole wheat; ground oyster shells and charcoal are kept constantly by them, and a good supply of clean water, a very essential requisite to the good health and vigor of laying hens. Through the winter months the hens average about one egg each every alternate day. Mr. Gordon prefers the incubator to the hen in hatching chickens. He thinks the chicks are stronger and better everyway, and a larger proportion of eggs can be hatched if the machine is rightly managed.

A. W. Gardiner is a breeder of Buff Leghorns, a favorite breed in this section, and growing in favor by all who have given them a trial. They are very handsome and prolific layers of large, rich eggs. This branch of the Leghorn family is an original variety from Denmark, and not, as some suppose, made up by crossing. The Buff Leghorn was first brought to the notice of fanciers in 1888 at the Crystal Palace show in England. Since then they have been in high favor, and a good specimen costs a large price. They are very rapid growers, and superior as egg producers. Their eggs are one-fourth larger than those of other Leghorns. The origin of the Buff Leghorn has been pretty clearly traced. They are believed to have come from Italy, through Denmark to England, where they were first shown in 1888. In their perfection the pullets are of a deep buff color throughout, approaching orange, though some are of a lighter shade. As the tendency is to fade out in the sun the darker color in the pullets, and especially in the male, secured by successive mating, is to be preferred. They are a little heavier than the White Leghorn.

C. A. Howe has Indian Game, White Wyandotte, and a fine flock of White-crested Black Polands. The last named are very handsome, and excellent layers. Beginning in March, each hen will produce an egg nearly every day through the season. Mr. Howe's Indian Games are compactly built, of pure blood, and highly prized.

C. H. Crehore and Mr. McKinsley, at Chicopee, are interested in the development of high-class fowls. Mr. McKinsley has Black Spanish. In Worcester, Mass., he took several prizes on his fowls. Mr. Crehore has Light Brahmas, Leghorns, and Indian Game. Light Brahmas are his favorite for general use, but he thinks the strife for fine feather and heavy weight of this breed, required of the prize winners, does not develop the most valuable points for general purposes. A large, fat Light Brahma is a very useless fowl among common people; but if grown for eggs and the table, a very desirable one. They easily take on fat and become clumsy and useless. If fed with care they are among the best winter layers we have.

At Hartford, Conn., and vicinity I found little interest in poultry culture. A few Indian Game and barred Plymouth Rock fowls are receiving some attention. The Poultry World is published in this city.

Interviewing the dealers in town, I learned that nearly all the eggs sold in this market came from New York State and the West; only a very few from the surrounding country. Four wholesale dealers report as follows:

	Dozen.
C. H. Russell handled, the past year	156,000
E. P. Yates	72,000
Perry & Son	360,000
Kingsley & Smith	300,000
Total	888,000

Kingsley & Smith sold 6,000 cases, or 180,000 dozen, during the past six months. These eggs came in car loads from outside the State, and were all disposed of within the city.

At Meriden, Conn., I found some interest. A. J. Coe has 200 White Leghorns and has engaged extensively in poultry raising. Three years ago he hatched over 3,000 chickens; last year some 1,500. His stock is now much reduced, as he contemplates changing to other breeds. Mr.

Coe uses an incubator of his own invention, and is quite successful in the hatching; but when about six weeks old the chicks begin to show weakness and a large proportion of them die before coming to maturity. This may be owing to machine hatching, but I surmise it is lack of care at the proper time, as the surroundings indicate it.

Mansfield Cole, of the same neighborhood, has a well-regulated establishment containing 600 birds, chiefly Light Brahmas and barred Plymouth Rocks. Mr. Cole gives his personal attention to his flock, and is making a profit in egg production. His poultry is kept in a steam-heated house and fed with care and regularity.

Mr. C. P. Jorden, at West Haven, has 200 Plymouth Rock and White Leghorn fowls, the two breeds best adapted for general use yet found, he says. Mr. Jorden is president of the New Haven Poultry Association, and is much interested in the advancement of poultry industry.

D. A. Hotchkins, proprietor of the Seaview poultry yards, has a very superior lot of Silver Laced Wyandottes. His accommodations are excellent, with the best of management. His hens average him 168 eggs each, annually. He feeds bran and corn meal in the morning, whole wheat and oats at night. A little animal meal is mixed with the soft-scalded food, alternate days.

The Farnham Brothers, 2 miles from New Haven, are breeders of high-class land and water fowls. They make a specialty of ducks and geese, having a large variety of the best breeds. The Farnhams are extensive market gardeners, but they intend soon to greatly enlarge their poultry stock and to keep an assortment of all the leading varieties of useful and ornamental fowls.

A. M. Lawson has 650 fowls of the Plymouth Rock and White Leghorn breeds. Eggs are his chief object, and he gets, at this time of year, about 200 daily from his entire flock. In March and April he expects to have 30 dozen daily. Mr. Lawson has had seven years' experience with poultry, and prefers the White Leghorn to all others for egg production. His buildings and accommodations are not of the best. If he would divide his flock into smaller lots and give them more care I think his profits would become much larger.

Capt. W. A. Pease, of Middletown, has Light Brahmas and Partridge Cochins of high order, and is trying by every attention to bring out their good points. F. C. Crosley keeps Light Brahmas, whose appearance shows very good management. I noticed his coops were thoroughly clean, and a thick coating of dry sand covered the floor, and in boxes for the droppings. No disease or vermin ever troubles his flock.

A. A. Bailey is interested in Light Brahmas and White Plymouth Rocks. He prefers the light-colored fowls because of their clean appearance when dressed for market, and thinks they are as good as the dark in all other points.

THE POULTRY INDUSTRY IN NEW JERSEY.

On a recent inspection through southern New Jersey, I made my first stop at Hammonton, located some 30 miles south of Philadelphia. This place, I think, is the banner town for broiler raising in the country, though a far less number are now grown than in former years. It is a business that requires capital to start with, and great care and constant attention to succeed, without which failure is inevitable. Of the forty or fifty people once engaged in this industry at Hammonton, I could find only eight or ten who had been successful. Dilapidated chicken houses are seen on every side as marks of failure.

G. W. Pressey is the pioneer in this section, or rather his two daughters, who have been successfully engaged in this business six years, having raised in that time over 25,000 chickens for broilers. It costs about 18 cents to grow and market a 1¼-pound broiler. A pair of such will average $1 in the New York market throughout the year. At one shipment the Misses Pressey sent to New York two barrels of broilers, containing 126 chickens, for which they received $128.50.

Charles Leonard is a successful grower. He now has 1,400 chicks from 1 to 12 weeks old, and adds about 240 each week from his incubators, which he will keep running through the entire season. He has been in the business five years, and thoroughly understands every detail. His hatch last season was 2,500, and averaged him $1 per pair in market. He buys all his eggs and uses a simple, homemade incubator.

Mr. Charles White has 500 young chicks and will raise some 2,000 the present year, running his incubator through the season, with a hatch every week. About 85 per cent of chicks hatched will make good broilers, and two-thirds of the eggs incubated is considered a very good hatch.

Mr. Henry Phillips has been one of the largest growers in Hammonton, but a fire destroyed his plant two years since, and he has not yet fully recovered. About 8,000 broilers have been his annual output in the past and he intends to greatly enlarge his establishment for more extensive operations.

Mr. H. Nicholai and Mr. A. Reed are both doing good work in this line of business. Mr. Reed is running four incubators, of 300 eggs each, at the present time, and has 800 young chicks growing finely. He produces his own eggs from 160 Plymouth Rock hens, and thinks this far preferable to trusting to outsiders for his egg supply.

The successful growers seem to follow nearly the same line of operation. Their brood houses are of simple construction of any desired length, divided into apartments of about 5 by 10 feet each. The brooders are arranged along the entire length of the building and are warmed by steam from pipes connected with a heater adjoining the first apartment. When the chicks are taken from the incubator they are put under the brooder in the first division (the warmest) and kept twenty-four hours without food, at a temperature of 95° to 100° F., or nearly the temperature of hatching. This is a very important point, as a chill at this stage is almost sure death to the chicken.

The first feed consists of baked corn cake made as follows: 3 quarts corn meal, 1 quart wheat middlings, 1 cup meat meal, mixed quite stiff with cold water or skimmed milk, and baked. When cold it is crumbled fine and fed freely—all they will eat the first week, or during the time they are kept confined in the warm room, which must never be over ten days. Mashed potato is given once a day, and plenty of clean water to drink, and a good supply of coarse sand and charcoal. At the end of a week the first brood is moved in to the second division and a new crop from the incubator takes its place. At about the twelfth move, or when the chicks are 12 weeks old, they are fit for market. During the older stage the chickens are allowed an outdoor run, and are fed with stronger food, consisting of 2 parts corn, 1 part wheat, and 1 part oats, ground together quite fine. To each 10-quart pailful of this mixture are added 1 quart of wheat bran, one-half cup pulverized bone meal, 1 pint of middlings and 1 pint of meat meal, mixed rather dry with hot water, and left to swell two hours before feeding; some kind of green food and clean water is always kept before them.

At Atlantic City, N. J., I found an active interest in poultry products, but little live stock. To give some idea of the egg trade in this city by the sea, I would state that one house handled, in July and August last, 7,500 dozen per week. During six months of the year 3,000 dozen weekly. The rest of the year 50 cases weekly, or a total of 156,000 dozen in twelve months.

L. W. Hopkins & Co. handled 1,350 cases in three months during the height of the season; the rest of the year 25 cases weekly, a total of 67,000 dozen annually.

There are two other wholesale houses in the city doing about the same amount of business. Atlantic City contains a population of 15,000, and there are some fifteen first-class hotels. It is estimated that these hotels alone use 75,000 dozen eggs during the months of July and August.

At Vineland I found a marked improvement in poultry and poultry culture since my last inspection. The stock has improved, and the care and attention are much more satisfactory. Several new and extensive yards have been started with prospect of success, and the development of a high grade of poultry is evident.

Respectfully submitted.

J. A. DODGE,
Stock Correspondent.

BEVERLY, MASS.,
December 23, 1892.

THE MULE: ITS USES, HOW TO BREED, GROW, PREPARE FOR THE MARKET, AND SELL.

By J. L. JONES, *Columbia, Tenn.*

There are two kinds or classes of the mule, viz, one the produce of the male ass or jack and the mare; and the other, the offspring of the stallion and female ass or jennet. The cross between the jack and the mare is properly called the mule, while the other, the produce of the stallion and jennet, is designated a hinny. The mule is the more valuable animal of the two, having more size, style, finish, bone, and in fact, all the requisites which make that animal so much prized as a useful burden-bearing animal. The hinny is small in size, and is wanting in the qualities requisite to a great draft animal. This hybrid is supposed not to breed, as no instance is known to us in which a stallion mule has been prolific, although he seems to be physically perfect, and shows great fondness for the female, and serves readily. There are instances on record where the female has produced a foal, but these are rare.

The mule partakes of the several characteristics of both its parents, having the head, ear, foot and bone of the jack, while in height and body it follows the mare. It has the voice of neither, but is between the two, and more nearly resembles the jack. It possesses the patience, endurance and sure-footedness of the jack, and the vigor, strength and courage of the horse. It is easily kept, very hardy, and no path is too precipitous or mountain trail too difficult for one of them with its burden. The mule enjoys comparative immunity from disease, and lives to a comparatively great age. Pliny gives an account, taken from Grecian history, of one that was 80 years old, and, though past labor, followed those that were carrying material to build a temple. Dr. Reese mentions two that were 70 years old, in England. The writer knows of a mule in Middle Tennessee that, when young, was a beautiful dapple gray, but is now 30 years old, and is as white as snow. This mule is so faithful and true, and has broken so many young things to work by his side, that he bears the name of "Counsellor." The last time he was seen by the writer he was in a team attached to a reaper, drawing at a rate sufficient to cut 15 acres of grain per day.

Rome and Greece had their mules, which were used for carriages, the saddle, and carrying burdens. At this day they are used extensively in nearly all parts of the country where agricultural pursuits are carried on, as well as in the mining regions, the cotton belt, and all sugar-growing countries, where they have largely supplanted the horse. Mules are much used in Europe; Spain, Portugal, Italy, and France, being the countries where they are most used, and are prized highly for their gentleness and faithfulness.

In the United States the principal States in which mules are raised are as follows, in their order as to numbers foaled in 1889, viz: Missouri, 34,500; Texas, 25,300; Tennessee, 19,500; Kentucky, 18,200; Kansas, 8,200; Arkansas, 6,600; Illinois, 6,400; California, 5,000; Indiana, 4,400; Mississippi, 4,200; Alabama, 3,500; North Carolina, 3,300; Iowa, 2,300; Nebraska, 2,300; Georgia, 2,000; Virginia, 2,000; Louisiana, 1,300; Oregon, 1,300; Ohio, 900; South Carolina, 700, and Pennsylvania, 600. Many other States raised mules, making the number foaled, in 1889, 157,000. In the same year there were sold 330,000 mules, of which number Missouri furnished 68,300; Tennessee, 56,800; Kentucky, 50,000, and the other States in proportion, the sales being more than double the number foaled in that year, which is greater in proportion than any other kind of this class of live stock.

Kentucky mules are showy, upheaded, fine-haired animals, their extra qualities being attributable to the strong, thoroughbred blood in the greater part of their dams. The same may be said of Tennessee, where it is thought the climatic influences produce a little better, smoother, and finer hair, coupled with early maturity, which qualities are much prized by an expert buyer.

The mules in Missouri, Illinois, Indiana, and some other of the so-called Northwestern States have large bone, foot, body, and substance, and possess great strength, but they are wanting in that high style, finish, and fine hair that characterize the produce of some of the States further south, and are longer in maturing. Mule breeding in these States is one of the most important branches of industry, and is supposed to date back prior to 1787.

Mr. Pomeroy, of Massachusetts, in an essay on the subject, published in 1825, gives an account of raising mules from jacks imported from the Portuguese islands to Connecticut and Massachusetts before the Revolution. He says:

> He placed the jack in a district where there was the greatest number of mares of qualities so inferior that their colts would not compensate their owners for the expense of taking them to a horse, and contracted to purchase their animals at four months old. They were kept in herds, with precarious shelter in winter, having ample opportunity offered them to mature and transfer that propensity for kicking, which seems at first merely playful, into an habitual means of defense, to be exercised when the biped, or any other race of animals, approach them.
>
> In this kicking seminary they remained two years, and were then driven to market. This first experiment with the mule in the United States was brought about by the high price of mules in the West Indies, to which place these New England mules were exported.

"After this, in about 1787," says George W. P. Custis, esq., in an extract from a published letter, "the King of Spain sent to Gen. Washington the jack Royal Gift and a jennet, and Gen. Lafayette sent the Knight of Malta. The Knight was bred to the jennet, and produced the jack Compound, which was bred to the mares on the general's farm at Mount Vernon, and produced mules that sold for upwards of $200 each. At his deceased sale one pair of these mules were nearly 16 hands high."

"As to my opinion," says Mr. Custis, "of the value of mules, I shall always appear extravagant. I have scarcely a horse on my estate for agricultural purposes, nor would I accept of one as a gift, except for road wagons, of which I have no need, as my property lies on navigable water. Nothing was ever so good as mules for the uses of this, our Southern country; they live longer, eat less, and, above all things, are better suited to the labor of this country than any other animal could possibly be. Their strength, patient endurance of privation and hardships, slender pasturage, exposure—in short, all those ills to which animals are subject, gives the mule a decided preference in all of the agricultural States."

There is no kind of labor to which a horse can be put for which a mule may not be made to answer, while there are many for which mules are more peculiarly adapted than horses; among the rest, that of mining, where the mule is used, and many of them need no drivers. They can endure more hardships than the horse, can live on less, and do more work on the same feed than any other beast of burden we use in America.

A cotton-planter in the South would feel unwilling to raise his crop with horses for motive power. The horse and the labor of the cotton belt could not harmonize, while the negro is at home with the mule.

A mule may be worked until completely fagged, when a good feed and a night's rest will enable it to go; but it is not so with a horse.

The mule being better adapted for carrying burdens, for the plow, the wagon, building of railroads, and in fact all classes of heavy labor, let us see how it compares with that noble animal, the horse, in cost of maintenance.

From repeated experiments that have come under my observation in the past twenty-five years, I have found that three mules 15 hands high, that were constantly worked, consumed about as much forage as two ordinary-sized horses worked in the same way, and while the mules were fat the horses were only in good working order. Although a mule will live and work on very low fare, he also responds as quickly as any animal to good feed and kind treatment. True, it is charged that the mule is vicious, stubborn, and slow, but an experience in handling many mules on the farm has failed to sustain the charge, save in few instances, and in these the propensities were brought about by bad handling. They are truer pullers than the horse, and move more quickly under the load. Their hearing and vision are better than the horse. The writer has used them in all the different branches of farming, from the plow to the carriage and buggy, and thinks they are less liable to become frightened and start suddenly; and if they do start, they usually stop before damage is done, while the horse seldom stops until completely freed. The writer once saw a runaway of six teams in a cornfield, five of them being mules and the sixth a horse. The mules ran and capered until they came to the first batch of green grass, and there stopped to regale themselves, while the horse ran on until he stuck the plow in his back, greatly frightened. In less than ten minutes the five mule plows were going without a bolt broken, while the plow after the horse was a wreck, and the horse ruined for life. The mule is more steady while at work than the horse, and is not so liable to become exhausted, and often becomes so well instructed as to need neither driver nor lines.

In the town in which the writer lives, a cotton merchant, who is also in the grocery trade, owned a large sorrel mule, 16 hands high, that he worked to a dray to haul goods and cotton to the depot, half a mile from his business house. This mule often went the route alone, and was never known to strike anything, and what was more remarkable, would back up at the proper place with the load, there being one place to unload groceries and another for cotton.

They are also good for light harness, many of them being very useful buggy animals, traveling a day's journey equal to some horses. The writer obtained one from a firm of jack breeders in his vicinity, that was bred in the purple by them, as an experiment, being out of a thoroughbred mare by a royally bred jack. She is 16 hands high, as courageous as most any horse. In traveling a distance of 32 miles, this mule, with two men and the baggage, made it, as the saying goes, "under a pull," in four hours, and when arrived at the journey's end seemed willing to go on.

We do not wish to be understood as underrating the horse, for it is a noble animal, well suited for man's wants, but for burden-bearing and drudgery is more than equaled by the patient, faithful, hardy mule.

THE KIND OF SIRE TO BREED FROM.

There are two kinds of jacks—the mule jack and the jennet jack, or combined jack, that is good for either mares or jennets, and is used chiefly in breeding jacks for stock purposes. It is only with the mule jack that we will deal, as the jennet jack is too costly to breed to mares, as a rule, unless the mares are of extra quality.

A good mule jack ought to be not less than 15 hands high, and have all of the weight, head, ear, foot, bone, and length that can be obtained, coupled with a broad chest, wide hips, and with all the style attainable with these qualities. Smaller jacks are often fine breeders, and produce some of our best mules, and when bred to the heavier, larger class of mares show good results, but as "like produces like," the larger jacks are preferable.

Black, with light points, is the favorite color for a jack, but many of our gray, blue, and even white jacks have produced good mules. In fact, some of the nicest, smoothest, red-sorrel mules have been the product of these off-colored jacks; but the black jacks get the largest proportion of good-colored colts from all colored mares.

The breed of the jack is also to be looked into. There are now so many varieties of jacks in the United States, all of which have merits, that it will be well to examine and see what jack has shown the best results. We have the Catalonian, the Andalusian, the Maltese, the Majorca, the Italian, and the Poitou—all of which are imported—and the native jack. Of all the imported, the Catalonian is the finest type of animal, being a good black, with white points, of fine style and action, and from 14½ to 15 hands high, rarely 16 hands, with a clean bone. The Andalusian is about the same type of jack as the Catalonian, having perhaps a little more weight and bone, but are all off colors. The Maltese is smaller than the Catalonian, rarely being over 14½ hands high, but is nice and smooth. The Majorca is the largest of the imported jacks, the heaviest in weight, bone, head, and ear, and frequently grows to 16 hands. These are raised in the rich island of Majorca in the Mediterranean Sea. While they excel in weight and size, they lack in style, finish, and action. The Italian is the smallest of all the imported jacks, being usually from 13 to 14 hands high, but having good foot, bone, and weight, and some of them make good breeders. The Poitou is the latest importation of the jack, and is little known in the United States. He is imported from France, and is reported to be the sire of some of the finest mules in his native land. These jacks have long hair about the neck, ears, and legs, and are in some respects to the jack race what the Clydesdale is to other horses. He is heavy set, has good foot and bone, fine head and ear, and of good size, being about 15 hands high.

The native jack, as a class, is heavier in body, having a larger bone and foot than the imported, and shows in his entire make-up the result of the limestone soil and grasses common in this country. He is of all colors, having descended from all the breeds of imported jacks. But the breeders of this country, seeing the fancy of their customers for the black jack with light points, have discarded all other colors in selecting their jacks to breed to jennets, and the consequence is that a large proportion of the jacks in the stud now, for mares, are of this color.

The native jack, being acclimated and to the manor born, seems to give better satisfaction to breeders of mules than any other kind. From observation and experience it is believed that our native jacks, with good imported crosses behind them, will sire the mules best suited to the wants of those who use them in this country, and will supply the market with what is desired by the dealers. The colts by this class of jacks are stronger in make-up, having better body, with more length, larger head and ear, more foot and bone, combined with style equal to the colts of the imported jacks.

While many fine mules are sired by imported jacks, this is not to be understood as meaning that imported jacks do not get good foals, yet, taken as a class, we think that the mule by the native jack is superior to any other class. This conclusion is borne out by an experience and observation of some years, and by many of the best breeders and dealers in the United States.

THE KIND OF MARE TO BREED FROM.

As the mule partakes very largely in its body and shape of its mother, it is necessary that care should be taken in selecting the dam. Many suppose that when a mare becomes diseased and unfit for breeding to the horse then she is fit to breed for mules. This is a sad mistake, for a good, growing, sound colt must have good, sound sire and dam.

The jack may be ever so good, yet the result will be a disappointment unless the mare is good, sound, and properly built for breeding. First, she should be sound and of good color; black, bay, brown, or chestnut is preferred. Her good color is needed to help to give the foals proper color, and this is a matter of no small importance, as we shall see further on.

This should not be understood as ignoring the other colors, for some of the best mules ever seen were the produce of gray or light-colored mares, as many dealers and breeders will attest. The mare should be well bred; that is, she would give better results by having some good crosses. By all means let her have a cross of thoroughbred, say one-quarter, supplemented with strong crosses of some of the larger breeds, and the balance of the breeding may be made up of the better class of the native stock. The mare should have good length, large, well-rounded barrel, good head, long neck, good, broad, flat bone, broad chest, wide between the hips, and good style.

HOW TO BREED THE MULE.

Having selected the sire and the dam, the next thing is to produce the colt. The sire, if well kept and in good condition, is ready for business, but not so with the mare. The dam is to be in season; that is, in heat. She should be bred about the first of April in the latitude of Tennessee, and at other places as the season opens, according to climate. Before being bred, to prevent accidents, the mare should be hobbled or pitted. Having taken this precaution, the jack may be brought out, and both will be ready for service. Care should be taken not to overserve the jack, as he should not be allowed to serve over two mares a day, and not nearer than eight hours apart.

The mare, after being served, may be put to light work, or put upon some quiet pasture by herself for several days until she passes out of season, when she may be turned out with other stock to run until the eighteenth day, when she should be taken up to be teased by a horse, to ascertain if she be in season, and if so, she should be bred again. Some breeders think the ninth, some the twelfth, and some the fifteenth day after service is the proper day to tease, but observation has taught us that the best results come from the eighteenth-day plan. After she becomes impregnated she should have good treatment; light work will not hurt her, but care should be taken not to overexert. She should have good, nutritious grass if she runs out and is not worked, but if worked she should be well fed on good feed. The foal will be due in about three hundred and thirty-three days. As the time approaches for foaling the mare should be put in a quiet place, away from other stock, until the foal is dropped. She will not need any extra attention, as a rule, but should be looked after to see that everything goes right.

After the foal comes it will not hurt the mare or colt for the dam to do light work, provided she is well fed on good, nutritious food. Should she not be worked and is on good grass, and fed lightly on grain, the colt will grow finely, if the mare gives plenty of milk; if she does not the foal should be taught to eat such feed as is most suitable.

The size of the colt at foaling time and the way it grows until weaned will determine whether it will make a cotton or a sugar mule. If the colt, when foaled, is 3 feet 5 inches and upwards, and grows nicely, it will make a sugar mule; if under the above height it will be a cotton mule. A sugar mule when grown is from 15.3 to 16.3 and even larger, heavy bodied, well boned, square, and stylish. They are used on the sugar farms in Louisiana and for dray purposes in the cities, and on farms for heavy work, and for teaming. For all of such purposes these mules are peculiarly fitted.

The cotton mule, as it is called, whether it ever sees a cotton field or not, is under the size of the above, but is of the same conformation as his larger brother. The larger of these so called cotton mules are sold in the heavier soils in the cotton belt and in all of the agricultural States to mining companies, and to street-car companies.

The colt should be well cared for at all times, and particularly while following its mother, for the owner may want to sell at weaning time, which is 4 months old, and its inches then will fix the price. Good sugar mules at weaning time usually bring from $75 to $90, and sometimes as high as $100, while cotton mules bring much lower prices, according to size and make-up.

Feeders, dealers, and buyers prefer the mare mule to the horse, and they sell more readily. The females mature earlier, are plumper and rounder of body, and fatten more readily than the male. When carried to the Southern market, where the buffalo gnats exist, these pests trouble the males more by biting their sheaths. The males are also more leggy and angular of body, are slower in maturing, and, as a rule, must be older to fatten readily. Great numbers of mules are bought at weaning time in Missouri, Illinois, Indiana, Kentucky, and Tennessee, and other States, and are herded together and raised until they are fitted and sent to market.

In weaning the colt, much is accomplished by proper treatment, preparatory to this trying event in the mule's life. It should be taught to eat while following its mother, so that when weaned it will at once know how to subsist on that which is fed to it. The best way to wean is to take several colts and place them in a close barn, with plenty of good, soft feed, such as bran and oats mixed, plenty of sound, sweet hay, and in season, cut-grass, remembering at all times that nothing can make up for want of pure water in the stable. Many may be weaned together properly. After they have remained in the stable for several days they may be turned on good, rich pasture. Do not forget to feed, as this is a trying time. The change from a lactic to a dry diet is severe on the colt. They may all be huddled in a barn together, as they seldom hurt each other. Good, rich clover pastures are fine for mules at this age, but if they are to be extra fine, feed them a little grain all the while.

There is little variety in the feed until the mules are 2 years old, at which time they are very easily broken. If halter-broken as they grow up, all there is to do in breaking one is to put on a harness and place the young animal beside a broken mule, and go to work. When it is thoroughly used to the harness the mule is already broken. Light work in the spring when the mule is 2 years old will do no hurt, but in the opinion of many breeders and dealers make it better, provided it is carefully handled and fed.

If the mules are of what is called the sugar type, and it is desired to feed them for what is termed the "green sugar market," which means 2-year-old unbroken mules, the fattening should begin in September or October after the mules are 2 years old. If cotton mules, they should be placed in the barn and fed preparatory for the market.

HOW TO FATTEN THE MULE.

This is one of the most important parts of mule-raising, for when the mule is offered to a buyer he well at once ask, "Is he fat?" and fat goes far in effecting a sale. A rough, poor mule could hardly be sold, while if it is fat the buyer will take it because it is fat.

The sugar mule should be placed in the barn with plenty of room, and not much light, about the 1st of November, before it is 2 years old, and fed about 12 ears of corn per day and all the nice, well-cured clover hay it will eat, and there kept until about the 1st of April. Then in the climate of middle Tennessee the clover is good, and the mule may be turned out on it, and the corn increased to about 20 ears or more per day. They will then eat more grain, without fear of "firing;" that is, heating so as to cause scratches, as the green clover removes all danger from this source. During the time they run on the clover they eat less hay, but this should always be kept by them. About the 1st of May, the clover blooms, and is large enough to cut, in the latitude of Tennessee. The mules should be placed, then, in the barn, with a nice, smooth lot attached, and plenty of pure water. A manger should be built in the lot, 4 feet wide by 4 feet high, and long enough to accommodate the number of mules it is desired to feed. This should be covered over by a shed high enough for the mule to stand under, to prevent the clover from wilting. The clover should be cut while the dew is on, as this preserves the aroma, and they like it better. While this is going on in the lot, the troughs and racks in the barn should be supplied with all the shelled corn the mules will eat. "Why shell it?" some one will ask. Because they eat more of it, and relish it. A valuable addition at all times consists of either short-cut sheaf oats, or shelled oats, and bran, if not too expensive.

From the 1st to the 15th of June barley is harvested in this latitude, and it should be ground coarsely. The mules should be fed on this, all they will eat, taking care that no feed is permitted to get sour. We usually have about this time some early varieties of corn, planted for the purpose of making early roasting ears; this is now cut in the field, and carried to the manger in the lot, and the ears pulled off, carefully husked and placed in the troughs in the barn, the stalks put in the manger. At no time must the feed be mixed, but the shelled corn, oats, bran, and roasting ears kept at all times in separate parts of the trough. By this time the mule is something of an epicure, and no more wants its feed mixed than a gentleman does his bread, meat, and potatoes.

From this time the mule should be pressed with all the richest of feed, if it is desired to make it what is termed in mule parlance "hog fat." All the roasting ears, ground barley, shelled oats, bran, and shelled corn, should be fed, not forgetting to salt regularly all the while, nor omitting the hay and green-corn blades. While all those are essential, shelled oats and bran, although at some places expensive, are regarded as the *ne plus ultra* for fattening a mule, and giving a fine suit of hair. Be sure to keep the barn well bedded, for if the hair becomes soiled from rolling it lowers the value, as the mule is much estimated for its fine coat.

The grain makes the flesh, and the green stuff keeps the system of the mule cool, and balances the excess of carbonaceous elements in the grain fed.

This manner of feeding, if properly carried out, with the proper foundation to start with, will make sugar mules, 2 years old past, weigh from 1,150 to 1,350 pounds by September 1, at which time the market opens.

A feeder of eighteen years' experience claims that shelled oats and bran will put on more fine flesh in a given time, coupled with a smoother, glossier coat of hair, than any other known feed. The experienced feeder follows this method from weaning till 2 years old.

The same care and attention requisite in feeding the sugar mule must be observed in the cotton mule, only the cotton mule is taken up about the 1st of August after it is 2 years old, and fed on green corn, shelled corn, plenty of good hay, and any kind of good green stuff at hand. Having fed it in the barn with door open into the lot until about November 1, when the weather will begin to be bad, the mule should be kept up in the barn and well bedded. If the hair does not appear as well as it ought to by the 1st of November some shelled oats and bran might be fed, to put on the fine finished, glossy coat and fat. This feeding until the 1st of January will make the mule ready for the market.

HOW TO SELL THE MULE.

New Orleans is the center of the sugar mule distributing region, while St. Louis, Mo., Louisville, Ky., Nashville, Tenn., and Columbia, Tenn., and other cities contribute largely in sending their products to the Southern markets of both classes of mules. All of the cities of the Western and Southern States demand large mules for their drays and heavy hauling.

If the seller has properly colored, well shaped, fine haired, fat mare mules in car-load lots, he should let the buyers know he has them, and there need be no trouble in selling. If one owner has not a car load, he should seek some one who is making up a car load to ship.

For some of the suggestions as to feeding, etc., in this article the writer is indebted to Col. J. W. S. Ridley, the "mule king" of Columbia, Tenn., the largest feeder and raiser of mules in the United States, and to J. W. Howard, esq., of the same place, one of the largest dealers and one of the best judges of the mule in the United States. To both thanks are hereby tendered.

CONTAGIOUS DISEASES AMONG DOMESTIC ANIMALS IN FOREIGN COUNTRIES.

In order to intelligently administer the law concerning the importation of cattle, sheep, and swine from foreign countries into the United States, the Secretary of Agriculture some time since requested the Secretary of State to cause to be forwarded to him from United States consuls abroad such official information as they might be able to gather concerning the prevalence of contagious diseases among domestic animals in their respective districts. The following extracts are made from reports thus received:

AUSTRIA.

John B. Hawes, United States consul at Reichenberg, Austria, under date of April 20, 1891, reports as follows:

In the 56 communities comprising this district there were, in the year 1889, 1,558 horses, 10,905 head of cattle, 9 sheep, 1,572 goats, and 1,009 pigs. During this period the foot-and-mouth disease showed itself in the following stables: In Koblige, in 2 stables; in Ketten in 2; in Grafenstein, out of 124 head, 116 cattle were at one time infected; in Mühlscheibe, in 2; and in Neuland and Niederberzdorf, each 1 stable.

In 1890, in the same district, were 1,569 horses, 12,519 cattle, 25 sheep, 2,713 goats, and 1,047 pigs During this year the foot-and-mouth disease was found in the following stables: In Berzdorf, 6 out of 8 head of cattle were infected; in 2 stables in Ruppersdorf, 20 head of cattle were infected, and only 2 head of cattle, 2 goats, and 18 sheep were healthy. In Moffersdorf, out of 45 cattle on the 9th of April, only the 6 bulls were sick. In Münchendorf, on December 10, 5 head of cattle were sick, and on the same day in Lashal, 5 also were found sick. On 20th December, in Moffersdorf, 1 cow was found sick. On December 23, in Althabendorf, 3 cows were sick, and in Machendorf, 6. On 26th December, in Hodendorf, 12 head of cattle were sick, as was also the case in Oberkratzan. On December 25 a case of anthrax was discovered in one stable in Juschmanitz; the owner was infected and died on the 29th. Four cows from this stable were killed but were found healthy.

SWEDEN.

Axel Georgii, vice-consul at Stockholm, Sweden, under date of June 2, 1891, writes as follows:

There are very few contagious diseases among domestic animals in this country. Two years ago there was some hog cholera, but since a year and a half there have been no traces at all of this disease. Among horses occasionally glanders appears in a stable here and there, but very seldom; that stable is then isolated and disinfected. The proceedings are similar in cases of inflammation of the milt, which appears a little more often than glanders. On the whole, however, the general situation in this respect is very healthy here. There are no official reports issued regularly about these diseases. In each special case the governor of the province issues necessary regulations.

Should there occur any serious illness in any large locality, and any official notice of infection be declared, I shall take care to report.

Before finishing I beg to point out that the sanitary condition among domestic animals here is so good that Sweden has had no difficulty at all regularly, without obstruction, to export cattle, horses, and swine to England, Germany, and other countries in Europe.

DENMARK.

Henry B. Ryder, United States consul at Copenhagen, Denmark, under date of March 31, 1891, states:

The various contagious diseases of domestic animals in this country, which have come to the public knowledge in the course of the years 1889 and 1890, were as follows:

For the year 1889, likewise as in previous years, the official reports of the veterinary board of health were not published until the close of the year, while from January 1, 1890, monthly reports are issued.

The contagious diseases of malignant character most generally occurring in this country are classed under the following heads: I, anthrax; II, erysipelas in hogs; III, scab in sheep; IV, glanders; V, myelitis typhosa; VI, hydrophobia in dogs; VII, hog cholera. The less dangerous diseases are: (*a*) mouth disease in horses; (*b*) smallpox; (*c*) strangles; (*d*) malignant catarrh in cattle; (*e*) malignant lung disease in horses, and other typhoid diseases; (*f*) dermatitis acutis in hogs; (*g*) fluor albus contagiosa et tabes dorsalis (*morbus coïtus*); (*h*) scab (not in sheep); (*i*) ringworm; (*k*) septicæmia hæmorrhagica, and (*l*) emphysema anthracis.

The cases of contagious animal diseases reported by the veterinary board of health for 1889 were as follows:

Anthrax occurred in cattle at 27 places in different parts of the country; besides, there were 2 cases in Zealand and 7 cases in Jutland, in which, at the same time, other domestic animals were also attacked. Furthermore, there were 3 cases of anthrax in swine. Detailed accounts of the diagnosis of this disease, in each case separately, were furnished by the local veterinary surgeons and published in the official report.

Erysipelas in hogs.—The reports from the local veterinary surgeons from all parts of the country show the following totals for this disease:

The malady made its appearance in 384 stocks, representing 3,376 individuals, out of which 1,019 were attacked; of these 661 died from the disease, 11 were killed, and 80 slaughtered.

The contagion was most ravaging toward the close of the year, and the total of infected stocks and individuals was greater than for any of the preceding eighteen years. While the disease had somewhat abated in western Jutland and on the island of Fünen, where, in 1888, it was widely extended, it had in 1889 much increased in the northern part of Jutland and Zealand, where it appears to have been introduced by breeding stock from the quarters in Jutland worst ravaged by the disease during the previous year. On 37 farms the stock of hogs of each farm, consisting of 20 to 118 individuals, and representing altogether 1,355 head, 202 of the animals, or 15 per cent, were attacked. On the remaining 347 of the infected farms, each having less than 20 animals, and consisting in all of 2,021 individuals, 817 animals, or 40 per cent, were attacked. The mortality from this disease (when the killed and slaughtered animals are counted in) was, for the whole country, 73.4 per cent of the infected animals.

Scab in sheep.—At the general inspection of sheep in the spring two-thirds of the individuals in the western part of Jutland were found to be badly infected by scab.

Glanders.—Of this dangerous disease there were 9 cases in three places where the total number of horses kept were 21 individuals. The cases were all on Zealand. The number of contaminated places were less, but the number of infected horses about the same as in the two preceding years. In three places where glanders were suspected the suspicion proved eventually unfounded. Very full and detailed descriptions of the veterinary observations both of the actual and suspected cases of glanders are communicated in the official report.

The law provides that horses attacked by or suspected of being infected by glanders shall be killed, partly at the expense of the State and partly at the expense of the local community in which the disease occurs. The total appraised value of horses killed on account of glanders was 6,750 kroner, of which amount 3,200 kroner come on horses in which the suspicion of infection was not corroborated by the surgical investigation of the dead bodies.

Myelitis typhosa.—This disease was of more frequent occurrence than in the preceding eighteen years. In 24 stocks of horses, mostly in Jutland, a few on Zealand, none on the other islands, the said stocks, consisting altogether of 107 individuals, 40 adult and 6 young horses, were found attacked; 22 died from the disease and 4 were killed.

Hydrophobia.—A single case occurred in a dog on a small island in the Baltic Sea; at all events, the board of health found reason, from the description given by the local veterinary surgeon of the demeanor of the dog, to consider it a case of hydrophobia, and the dog was killed and proper measures taken.

Hog cholera.—Of this disease a few cases were reported, all on Zealand, and all the cases, or most of them at least, could be traced back to a single starting point, an unthrifty herd from which animals had been sold to farmers in different localities. Altogether 46 animals, valued at 1,327 kroner, were killed. At the professional examination of the carcasses, however, only 9 cases of contagion were substantiated. This low figure of actual cases of disease in proportion to the number of animals killed on suspicion is evidence of the stringency of the measures taken by the proper authorities in this country for the extermination of contagious diseases among domestic animals.

Contagious diseases of a milder character.—Reports of this class of diseases (such reports being compulsory) were sent to the veterinary board of health from 399 practicing veterinary surgeons, of which 192 had treated cases of such diseases, while 207 reported "no cases treated." The official reports of the veterinary board were missing from 8 veterinary surgeons at the time of going to print.

Mouth disease in horses was of less frequent occurrence than in the two preceding years. The malady showed itself in 205 stocks, consisting of 910 horses, of which 305 adult and 122 young individuals were attacked, much the greater number of cases being in the most northern part of Jutland, and increasing fast in the latter months of the year. There was one case of death.

Smallpox was observed in 8 horses in different parts of the country. In one of the infected places the owner and the groom had pustules scattered on their hands and faces, which, however, did not affect their general health. In another place the nurse of an infected horse got some eruption on one of his hands.

In *cattle* the disease was more widespread than in any of the next preceding eighteen years. The cases were 540 adult and 7 young animals in 97 stocks, representing 2,138 animals. All the cases were cured. In one of the infected places, in the southwestern part of Jutland, two milkmaids had eruptions on their hands of the same character and appearance as the pox on the cows.

In *swine* smallpox appeared in 11 young individuals in two places in the northern part of Zealand.

Of *strangles* 1,230 cases were reported in adult and 928 cases in young horses in 1,057 places, the total stock of which was 5,028 horses (the stock of horses for military use not being considered). Twenty-nine of the diseased animals died and 2 were killed. The number of cases was about the same as the year before. As usual, the disease was most severe during the autumn and early winter months, and April, May, and June.

Malignant catarrh in cattle appeared in somewhat fewer herds than in the next preceding years, much decreasing toward the close of the year.

In 29 stocks, representing 713 animals, mostly in Jutland, a few on Zealand and Lolland, none at all on the island of Fünen or the smaller islands, 32 adult and 13 young cattle were attacked. Twenty of the diseased animals died, 9 were killed, and 3 slaughtered.

An interesting correspondence between the veterinary board of health and the secretary of the interior in relation to a very stubborn and extraordinary case of this disease is published in the official report. The disease in question, which appears sporadically off and on in this country, seldom lasts very long, but generally disappears after the death of several of the attacked animals in a stock. In this special case, however, the disease occurred repeatedly in spite of the energetic application of the curative measures prescribed by law, including a thorough disinfection and the ultimate tearing down of the cow stable and the erection of a new one removed 18 yards from the original site. The veterinary board of health thought it likely that the new stable may have been built too near the old one, and that the ground may perhaps be pervaded by disease germs. But as the special bacteria causing the disease have not yet been discovered by science, the board were of the opinion that a local bacteriologic investigation, as proposed by the secretary of the interior, would not lead to any practical result at present. The board ultimately suggested that public support be given to a change of stock-keeping at the estate in question, changing from cattle exclusively to horse and sheep farming for several years. If further light should be thrown on this subject I may in a future report, if desired, treat more in detail on this theme.

Dermatitis acuta in swine showed itself in 38 stocks, consisting of 208 animals. Twenty-six adult hogs and 32 pigs were infected; 1 death; 1 killed.

Fluor albus contagiosa et tabes dorsalis (morbus coïtus) in cattle was reported in 17 stocks, representing 245 animals, of which 32 suffered from the disease. All cured.

Scab in horses.—Twenty-three animals in 13 stocks, representing 84 individuals No deaths.

Scab in cattle.—Twenty-four cases in 2 stocks, representing 220 individuals. No deaths.

With *ringworm* were affected: (*a*) 16 horses, (*b*) 93 cattle in 56 stocks representing 2,765 animals; (*c*) 9 hogs and pigs in 2 stocks, representing 48 individuals. Reported were, furthermore, (*d*) 2 dogs and (*e*) 1 cat.

Septicœmia hœmorrhagica attacked 12 calves in a stock of 18. Eight of the infected animals died; 1 was killed.

Emphysema anthracis was reported in 9 stocks of cattle, consisting of 348 head. Two adult and 8 young individuals were attacked; 3 died, 2 were killed, and 3 slaughtered.

Withholding of live stock destined for exportation to England.—As evidence of the vigilance and care exerted by the appointed authorities in this country, not only in the combating of more or less severe and dangerous contagious diseases of domestic animals, but also in maintaining the confidence of the foreign countries to which live stock is exported, I beg to point out the fact that in the year 1889 no less than 2,476 animals, viz, 1,524 head of cattle, 827 sheep, and 128 hogs, were withheld from exportation to England, not because of any actual or suspected infectious disease, but owing, in most cases, to slight defects or maladies that might arouse suspicion on arrival of the animals in England. Some of the causes of prohibition of exportation may serve as an illustration of the rules prescribed in such cases; for instance: wounds or eruption in the mouth, on the feet, or elsewhere; lameness or sore gait; lung affections; fever; faintness; swellings; tumors; discharge from the nose; congestion of the brain; diarrhea; actinomycosis, etc.

For the year 1890 and henceforth the veterinary board of health issue abbreviated temporary monthly reports of the most important malignant contagious diseases. The annual official report for the year in question having not yet been published, I give in the following the essential contents of the aforesaid monthly reports.

In the month of January myelitis typhosa was reported in 2 stocks of horses, anthrax in 7 stocks of cattle, erysipelas in 37 stocks of swine.

From the reports in the same month it appears that public inspection had been discontinued in four places that had been infected with myelitis typhosa in horses, in 5 stocks of cattle that had suffered from anthrax, and 32 stocks of swine that had been affected with erysipelas.

In February: Myelitis typhosa in 2 stocks of horses; anthrax in 6 stocks of cattle; erysipelas in 18 stocks of swine. Discontinued public inspection in 2 stocks of horses with myelitis typhosa; 10 stocks of cattle with anthax; 28 stocks of swine with erysipelas.

In March: Myelitis typhosa in 5 stocks of horses; anthrax in 5 stocks of cattle; erysipelas in 19 stocks of swine. Discontinued public inspection of 3 stocks of horses with myelitis typhosa; 4 stocks of cattle with anthrax; of 17 stocks of swine with erysipelas.

In April: Glanders in 1 stock of horses; anthrax in 6 stocks of cattle; erysipelas in 10 stocks of swine. Discontinued public inspection of 2 stocks of horses with myelitis typhosa; 10 stocks of cattle with anthrax; 10 stocks of swine with erysipelas.

In May: Myelitis typhosa in 1 stock of horses; anthrax in 4 stocks of cattle; erysipelas in 15 stocks of swine; chronic hog cholera (caseous inflammation of the bowels) in 1 stock of swine.

With regard to the latter disease, this is the first case substantiated in this country. A few other cases have been suspected. It is considered to be beyond a doubt that the disease has existed throughout central Europe for a series of years. There is a marked distinction between this chronic and the acute form of hog cholera, the former being much less contagious and almost exclusively attacking young pigs, of which the more robust and well-developed often survive the disease. While this form of hog cholera may be dangerous to the stock in which it appears, it does not seem very apt to spread abroad, and especially the infection is not scattered about by means of attending persons or lifeless objects, but only by infected pigs.

Discontinued public inspection of 2 stocks of horses with myelitis typhosa; 4 stocks of cattle with anthrax; 13 stocks of swine with erysipelas.

In June: Myelitis typhosa in 1 stock of horses; anthrax in 7 stocks of cattle; erysipelas in 36 stocks of swine. Discontinued public inspection of 2 stocks of horses with myelitis typhosa; 14 stocks of cattle with anthrax; 25 stocks of swine with erysipelas.

In July: Myelitis typhosa in 2 stocks of horses; anthrax in 2 stocks of cattle; erysipelas in 55 stocks of swine; chronic hog cholera in 2 stocks of swine. Discontinued public inspection of 1 stock of horses with myelitis typhosa; 2 stocks of cattle with anthrax; 33 stocks of swine with erysipelas.

In August: Myelitis typhosa in 1 stock of horses; anthrax in 2 stocks of cattle; erysipelas in 72 stocks of swine. Discontinued public inspection of 1 stock of horses with myelitis typhosa; 49 stocks of swine with erysipelas.

In September: Anthrax in 5 stocks of cattle; erysipelas in 88 stocks of swine; chronic hog cholera in 1 stock of pigs. Discontinued public inspection of 1 stock of horses with glanders; 75 stocks of swine with erysipelas; 1 stock of swine with chronic hog cholera.

In October: Myelitis typhosa in 2 stocks of horses; anthrax in 3 stocks of cattle;

erysipelas in 81 stocks of swine; chronic hog cholera in 1 stock of swine. Discontinued public inspection of 1 stock of horses with myelitis typhosa; 1 stock of cattle with anthrax; 92 stocks of swine with erysipelas.

In November: Myelitis typhosa in 1 stock of horses; anthrax in 6 stocks of cattle; erysipelas in 62 stocks of swine. Discontinued public inspection of 3 stocks of horses with myelitis typhosa; 2 stocks of cattle with anthrax; 68 stocks of swine with erysipelas; 1 stock of swine with chronic hog cholera.

In December: Myelitis typhosa in 2 stocks of horses; anthrax in 5 stocks of cattle; erysipelas in 38 stocks of swine. Discontinued public inspection of 3 stocks of horses with myelitis typhosa; 6 stocks of cattle with anthrax; 61 stocks of swine with erysipelas; 1 stock of swine with chronic hog cholera.

RUSSIA.

Thomas E. Heenan, United States consul at Odessa, Russia, under date of March 7, 1891, makes the following report:

I have the honor to inform you that the most important among the causes which tended toward the keeping down, or even the entire destruction of cattle-breeding in Russia, was the plague (*pestis bovina*) which until lately appeared as a heavy scourge to the Russian agricultural population.

The constant place of origin of this disease was in the southeastern steppe provinces of Russia, whence it was annually carried to all other provinces, until the years 1881, 1882, and 1883, the plague caused the death of nearly 400,000 head of cattle annually in European Russia alone, which was from 1½ to 2 per cent of the total number of cattle then kept. Taking the average price of every head of cattle killed by the plague to be only $10, the annual loss would be $4,000,000. In addition to this enormous direct loss, the disease had a very detrimental effect on all farming operations, especially as regards the small peasant farmers in northern and central Russia. In losing his cattle, the peasant also lost his only manure, and in the south his most important working power, which was indispensable for the tilling of the ground. The fields therefore used to remain without manure and gave very poor crops, or they remained untilled or unsown. The plague also had a very bad effect on the export trade of cattle and animal produce. The states of western Europe, dreading the importation from Russia of this infectious disease, closed all their markets against Russian cattle, prohibiting their importation. In view of the great loss caused by the plague and the evident inefficiency of the provincial municipal councils to arrest its progress, the Russian Government resolved in 1886 to take the matter into its own hands. It gradually extended the application of the law of 1879 regarding the compulsory destruction (killing and burying) of all suspected animals, to all of European Russia and to the provinces of the Caucasus which lie north of the mountain range, prohibiting at the same time the driving of animals along those cattle tracks which have railroads running parallel to them. It further began to submit the herds of cattle to a careful sanitary supervision and inspection and increased the number of veterinary surgeons almost fourfold. These measures resulted in the stamping out of the plague in 44 provinces. The number of animals which fell victims to the disease was reduced in 1888 to 37,000, *i. e.*, it was reduced to almost one-tenth of the animals annually lost in the triennial period of 1883–'85. About the beginning of 1889 the plague was localized to only six provinces and territories of southeastern Russia, viz, the Don Cossack and Kuban territories, and the provinces of Stanopol, Astrakhan, Samara, and Ufa. The following table shows the number of infected districts in each province during the year ending December 31, 1890:

Name of province.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Terek	2	1	1				1	2	2	3	5	5
Kuban	4	5	2	1	1	1	2	2	3	3	3	3
Stanopol	3	2	1	2	2	3	3	2	2	4	3	3
Astrakhan	2	1		1		1						
Don territory	2	1										
Others												
Total	13	10	4	4	3	5	6	6	7	10	11	11

The above table shows that the plague had been confined to five provinces at the end of 1890, as compared with six provinces at the close of 1889. It naturally follows that the smaller the area to be dealt with the easier it is to fight the plague successfully. It is to be hoped, therefore, that the current year will find Russia entirely free from this scourge.

Under date of March 10, 1891, Consul Heenan further reports as follows:

The anthrax (*carbunculus epizoöticus*), which is best known in this country under the name of "Siberian plague," or "tumorplage," is, next to the pestis bovina, the most destructive of animal life, nor does it spare man in its ravages. It has never caused so much loss in any one year as the pestis bovina, but on the other hand it is much more difficult to eradicate. The strictest prophylactic measures and the killing and burying of the diseased animals have not yet produced the desired result. It would almost seem as if this disease originated spontaneously, and the causes which generate it have not been fixed. It can not be said that the disease has as yet been excluded from any single province of Russia. Vaccination has been recommended and tried, but the result was not always satisfactory; in one case several thousand sheep died after the operation. It was stated here by the veterinary authorities in this case that the disease proper had been inoculated instead of a cultivated and modified form of the bacilli. The anthrax is known to take several quite distinct forms. Thus the formation of the tumor only takes place where the development of the malady has passed into a chronic stage; when, however, the disease takes the acute or apoplectic form death ensues before the formation of any tumor. About 3,000 head of cattle and about the same number of horses annually fall victims to this disease, and perhaps three or four times that number of sheep; and this estimate is only for Russia in Europe exclusive of the Caucasus.

The *aphtha epizoötica*, or hoof and mouth disease, comes next in importance, and although it does not kill many animals, from one to three out of every thousand head, yet it inflicts very serious loss on the cattle farmers in another way. The aphthæ which form in the throat and mouth of the animals prevent them almost entirely from taking any except liquid food, such as boiled oil-cake, etc., which it is not always in the power of the inland farmer to procure. The animals, therefore, grow very lean, and although the disease scarcely ever extends to the hoofs, yet even the mild form which exists here, and which most of the veterinary surgeons claim to be only *febris aphthosa*, and not the real aphtha epizoötica, is a serious calamity, as it sometimes attacks thousands of animals. The attitude of the sanitary authorities with regard to this disease is very characteristic. No precautions of any kind are taken against it, and many farmers, when they think that some of their animals art infected keep them on purpose together with sound animals, so that the malady may spread to all of their animals at once and then pass away. Animals thus affected are permitted to be killed and the meat sold for eating. Hundreds of such animals are annually slaughtered in South Russia, and no bad effects have resulted from the use of the meat. The milk from cows attacked with this disease is not allowed to be sold for use in its fresh raw state, as it has been known to communicate the aphtha to the consumers, which in the case of children may even endanger life.

With regard to sheep it may be said that they are more or less subject to the same diseases as cattle, and of late years the *variola ovina* has in certain districts made great havoc among them, the mortality having occasionally exceeded 30 per cent of the animals attacked by the disease. Yet the disease is on the decrease. The mange, scab, or scurf is also on the decrease, which is ascribed to the fact that lately the fine-wool sheep have not been bred so much as formerly, owing to the fall in the prices paid for fine wools. The fine-wool or Merino sheep have been found to be much more subject to this disease than the coarse-wool sheep.

Goats are subject to the same diseases as sheep, but being much hardier they are less liable to infection.

It would appear that hogs are very seldom attacked by infectious diseases in Russia.

Horses often fall victims to the anthrax, but still it would seem that this disease does not originate with them, but is communicated to them by cattle. Nor can it be called an epidemic, as the cases are more or less sporadic and always remain limited in number. A far more dangerous disease for horses is the glanders, and it may be said to exist in every province of Russia and every year kills some animals; and this in spite of the very rigorous measures now adopted by the central government, which has issued orders that all animals found to be suffering from glanders be killed and buried. Before the war of 1876–'77 the disease in many provinces was nearly extinct, but of the numerous horses that formed the commissariat columns many had been infected with glanders, and when they came back were sold at auction and found their way to many provinces. The disease was thus spread all over Russia, all the more so because at that time the strict regulations of the present day did not exist.

Other diseases of much less importance might be mentioned, but their victims have been so few in number that it would seem unnecessary to report on them.

Joseph Rawicz, United States consul at Warsaw, Russia, writing under date of April 13, 1891, says:

In the Kingdom of Poland, during the year 1887, were noted the following cases of contagious diseases among domestic animals:

Cattle plague appeared in twelve places; 14 beasts died; 673 were killed; total, 687.

Glanders of horses appeared in forty-nine places; 210 beasts fell ill; 205 died or were killed.

Lung disease of cattle appeared in eighteen places; 220 beasts fell ill; 109 died or were killed.

Carbuncle appeared in one hundred and forty-eight places; 320 horses fell ill and 189 died; 692 head of cattle fell ill and 576 died. Of other domestic animals 775 fell ill and 730 died. Total, 1,787 beasts fell ill of carbuncle and 1,495 died.

ITALY.

The United States consul at Milan, Italy, writing under date of January 31, 1891, reports upon cattle diseases in Lombardy as follows:

The recorded statements of the veterinary service of the public slaughter-houses in 1890, as also the records of the sanitary vigilance exercised in the same year over the numerous herds existing in Milan and the rest of Lombardy, do not indicate that any infectious contagious diseases prevailed, or are prevailing to any extent among the animals destined to be slaughtered. No fiduciary or rigorous sequestration nor any other prophylactic measures were consequently to be applied, as was done the preceding year, 1889. The mortality is much less for 1890 than for 1889. Some isolated cases of sporadic carbuncle were discovered in cattle coming from other places in each case, and have been reported to the authorities in accordance with the regulations relating to public health. No cases of contagious exudative pleuro-pneumonia. A great many cases of tuberculosis were verified as usual in slaughtered animals, and in some cases of actinomycosis of the face and tongue.

The thrush or vesicular halting sickness, frequently accompanied with the contagious aphtha, was and is still prevailing in the herds of the irrigated and marshy zones. A strict vigilance is exercised on the boundaries by the neighboring governments to the prevention of said herds, and horses have been entirely excluded. No cases of trichinæ spiralis in swine, but many cases of the so-called malrossino (reddish disease), and 99 cases of petecchial fever. These indigenous and permanent diseases in our herds have not, however, been developing into epizoötics. A few cases of halting sickness and of scab have been indicated in sheep. In dead animals consigned to the sardigna, viz, an establishment under special vigilance of the municipal authorities for preparing meat unfit for food for industrial purposes, as also animals coming from different places, 45 cases were verified of facial glanders. These were noticed in horses belonging to the army, and 10 similar cases in horses killed in the slaughterhouses, and which originated in fortuitous contacts taking place in markets and in the public stables where every hygienic care is lacking. In the stables where the horses affected with those contagious diseases were received the suitable and necessary expurgations are employed.

GREECE.

Under date of February 14, 1891, the United States consul at Patras states that he is given to understand that in the event of any contagious disease appearing among animals the local authorities have instructions immediately to report it, and measures are to be at once taken to localize the disease and kill all the animals affected. The only disease that he has ever heard of there among cattle is anthrax, but it does not exist now; the country is practically free from sickness among animals. Regulations exist to prevent the importation of diseased animals. What are imported come principally from Turkey and Russia.

TURKEY.

Z. T. Sweeney, United States consul-general at Constantinople, Turkey, under date of January 22, 1891, reports as follows:

I have the honor to acknowledge the receipt of your circular dated December 22, 1890, inclosing copy of a letter dated the 13th December, 1889, from the Secretary of Agriculture, desiring to be advised as to the kinds of contagious diseases among animals in Turkey, and asking for copies of bulletins issued by the Turkish Government on the subject. I herewith beg to inclose copies of ten official bulletins, containing the official information in the matter, and issued by the sanitary administration of the Ottoman Empire during the year 1890.

BULLETIN OF EPIZOÖTICS.

(1) *Aleppo.*—March 16-28, 1890. Le medecin sanitaire announces the complete cessation of "bovine epizoötic" throughout the vilayet (district).

Ismid.—March 15-27, 1890. The ministry of the interior announces the cessation of the bovine pest in the district of Ismid, except in the village of Guivé.

(2) *Yafa.*—April 16-28, 1890. Le medecin sanitaire writes that the governor of Palestine and also the caimacam of Yafa have officially notified him of the cessation of "bovine epizoötic" throughout Palestine.

(3) *Constantinople.*—June 5-24, 1890. The prefecture of the city announces the disappearance of the "bovine pest," which has heretofore raged in some villages of Tchataldja, as well as in Constantinople and environs. Meanwhile the prefecture adds that this malady still exists in some localities in the sandjak of Ismid. Upon this statement the administration ordered a clean bill of health as regards epizoötic to be delivered for Constantinople.

Sivas.—June 7-26. A telegram from the vali of Sivas announces the cessation of the epizoötic throughout that entire vilayet.

(4) *Adalia.*—August 10-29. A bovine epizoötic with great mortality is manifesting itself in the sandjaks of Sparti and Boudour.

(5) *Trebizonde.*—August 17-29. The bovine pest is manifesting itself in the district of Kurai-Tepe, dependency of Rize, Trebizonde. The mortality is very limited.

(6) *Samsoun.*—September 2-21. A bovine epizoötic with slight mortality has appeared in some villages of the districts of Inéboli and Bartine.

(7) *Samsoun,*—October 2-14. Le medecin sanitaire states that the bovine epizoötic (see Bulletin No. 6 of September 4-16 last) which existed in the districts of Bartine and Inéboli continues to rage with great mortality.

Adrianople.—November 2-21. The vali announces the appearance of an epizoötic in the nahye of Himet, caza de Malaka.

(8) *Beirut.*—November 12-30. Le medecin sanitaire informs us of the cessation of the epizoötic in the vilayet of Beirut (see Bulletins Nos. 17 and 19 of June 13-25 and July 11-23, 1889).

(9) *Erzerum.*—November 3-15. The epizoötic noted at Bayazid and Karaklisse has completely disappeared. (See Bul. No. 23 of 29-10 9-89.)

A bovine epizoötic has appeared at Alashkird and some neighboring villages.

(10) *Trebizonde,*—December 9. The epizoötic existing at Kurai-Tepe, district of Rize (see Bulletin No. 5 of Sept. 27-8) has developed in the mudirlik of Apavi, district of Rize.

Erhard Bissinger, United States consul at Beirut, Syria, under date of January 28, 1891, makes the following report:

(1) The principal contagious disease that prevails among cattle in Syria is the "bovine typhus." The other diseases to which Syrian cattle are sometimes—though infrequently— subject, are anthrax (plague-sores or carbuncles) and tetanus.

"Bovine typhus" raged in 1888, 1889, and 1890 in the vilayet (province) of Syria, and afterwards spread to the vilayet of Beirut; it is claimed that it was brought into Syria by cattle imported from the Caucasus.

No contagious diseases exist at present among cattle within the Beirut consular district.

(2) Sheep in Syria are often subject to the distemper, "rot," and to cachexy; the former ravaged among the sheep in 1889 in some parts of Syria, notably in the Akkar district, adjoining Tripoli, in the villayet of Beirut.

A great mortality also occurred among the sheep in 1890 throughout Syria, but this is said to have been due to insufficient protection against cold, and to want of proper pasture.

Swine are but little known in this part of the world.

No statistics being kept by the Syrian authorities, the extent of the various diseases above mentioned can not be ascertained.

Henry Gillman, United States consul, Jerusalem, Palestine, under date of January 29, 1891, reports as follows:

There has been no contagious disease among the domestic animals of Palestine for many years past. The freedom from all such trouble has been rather remarkable.

The excessive mortality among horses, sheep, and cattle in and around Jerusalem, from which we suffered towards the close of the summer and the beginning of autumn of 1890, had nothing of a contagious character about it. Indeed, with the exception of the sheep, there did not appear to be any particular known disease connected with this mortality. The hot weather, overdriving, and illtreatment, including insufficient or improper feeding, were, no doubt, the chief causes of the fatality, as regards the horses. Want of sufficient water, and that used being of inferior quality, contributed to produce the result complained of in the sheep and cattle, though in the former in most cases it was found they were afflicted with disease of the liver.

The loss to drovers and butchers was very great, especially in the case of sheep, amounting in more than one individual instance to $800 per week.

H. M. Jewett, United States consul at Sivas, Turkey, under date of April 1, 1891, reports as follows:

The following particulars as to cattle disease in this district have been furnished me by Dr. Dikran Sewny, of this city. Cattle disease—pneumonia and meningitis—always prevails to a lesser or greater extent in this vicinity. Owing to the climate and high altitude disease, however, does not spread rapidly. Little or no efforts are made to prevent its spreading or to counteract its effects. There is no system of official inspection. The people of a village will sometimes report to the governor that their cattle are dying in great numbers, and ask for some measure of relief. The petition will be referred to the municipal council with orders to look after the matter. The council accepts the petition, and that is usually the end of it. There is no veterinary surgeon in the province. The peasants are very ignorant about such matters, so that altogether really healthy cattle, free from all taint, are seldom found.

Last year pneumonia and meningitis prevailed in nearly all the villages of the province. Of those affected about 75 per cent died. The duration of the disease is usually from eight to fifteen days, but in many cases cattle died after one day's sickness. It should be said, however, that the Constantinople authorities deny the existence of pleuro-pneumonia. The symptoms described would, however, indicate that disease.

Last year a blacksmith was detailed to visit the villages and report on the extent and character of prevailing diseases among cattle. He was away some two months, but on his return was neither paid nor asked to make a formal report. He states that the number of deaths was enormous, but is unable to furnish figures. His method of treatment is to open an artery under the eye. If the blood is nearly black there is no hope of a cure, but if not, he pours buckets of water over the animal's head which usually effects a cure.

In two *kazas* (subdistricts) there were 1,500 deaths last year. In the village of Godun about 25 per cent of all the cattle died. In this city about 2,000 cows died.

A disease resembling pneumonia affects goats when other animals are free from it. Sheep are affected very extensively with a disease called by the natives *kepanek*. This disease, which is marked by the presence of worms in the liver, is not considered as injuriously affecting the flesh as an article of food. The sheep get fat when affected by it. The flesh becomes yellowish. As a means to prevent the spread of the disease the peasants fumigate the close stables where the sheep are housed by burning a mixture of *uzerlik*, dog's dung and tar.

Mr. Longworth, consular agent at Trebizonde, writes that since August 1, 1890, contagious diseases of cattle have ceased to manifest themselves in that vicinity.

Louis B. Grant, acting consul-general of the United States at Cairo, Egypt, under date of February 9, 1891, says:

Referring to the Department's circular, dated December 22, 1890, I have the honor to inclose herewith a report on the contagious diseases which existed among domestic animals in Egypt during the year 1889. The official returns have not yet appeared for the year 1890, but as soon as possible a similar report will be forwarded for this year.

According to the report of the chief veterinary officer, the contagious diseases which existed among domestic animals during the year 1889 were as follows:

Hydrophobia.—One case was discovered on the 6th of February. In this instance a dog bit four children, one of which subsequently died of rage. Three other cases are reported, but no immediate investigation having been made they were not confirmed. Total cases confirmed, 1. Total cases suspected, 3.

The measures proposed to prevent hydrophobia are quarantine on the importation of dogs and control over dogs in large cities.

Glanders (*morve et farcin*).—There were 74 cases of this disease during the course of the year, distributed as follows: Egyptian army, 58; army of occupation, 5; Cairo, 5; Alexandria, 5; Zagazig, 1; total, 74.

It is proper here to call attention to a disease, probably of an infectious character, which presents certain points of resemblance with the glanders, but which in the opinion of the veterinary officer is not identical with it. This malady attacks the lower cutaneous tissues and sometimes the lymphatic tissues of solipeds, and generally begins at the place where the animal has been hurt by its harness, which frequently occurs on the back where the saddle is placed, at the crupper, and at the upper joints of the forelegs. The disease is sometimes produced by the tears which run down the cheeks of sick animals. There appear in the sore spots one or two small abscesses which open and heal. Sometimes these abscesses break out in great numbers and follow the same course, leaving a small scar after healing. Then appears a well-defined ulcer, which is distinguished from that of the glanders by the fact that the hardening of its edges is not so pronounced. In some cases this disease is cured in a few days; in others it grows worse and causes death. Animals affected by this disease were isolated, and the stables occupied by them and the utensils used therein were disinfected. After recovery animals can be put to work again.

Strangles.—Two cases of this disease were discovered on horses at the Eautah fair on April 4. The animals were at once isolated, but were set free again after cure. Another horse was affected by the same disease in the same town on May 6, and was subjected to the same treatment.

The disease very rarely, if ever, has fatal results. Nevertheless, when several animals are attacked at the same time, there results a material loss of work to proprietors, and if prophylactic measures are not promptly taken the disease spreads from stable to stable, and has a tendency to take an epizoötic character.

Pleuro-pneumonia.—Only one suspected case was recorded during the year 1889. This case occurred on January 3 at Kessous, in the province of Kalioubieh.

Cattle plague.—The existence of this disease was discovered by the Egyptian military authorities in Suakim in February. Seventy-six animals died and 19 were killed voluntarily. Owing to the energetic measures taken by the authorities the disease soon disappeared. Total number of deaths, 95.

In the month of October, at Eamai, province of Dakahlieh, and in November at Koubbeh, near Cairo, a disease of an infectious character was discovered to be raging among cattle. In the former locality 3 animals died, in the latter 12. Total, 15 deaths.

Judging from the prognostic and diagnostic symptoms, and by the conclusions reached after autopsy, this lesion would appear to bear a strong resemblance to the carbuncle; but its likeness to angina permits of its classification for the present in the category of anthracitic angina. (French *angine anthracoide.*)

Inoculation was tried on rabbits without a decisive result, but it led to the belief that the disease was not identical with the carbuncle. Subsequently Mr. G. B. Piot, chief veterinary officer of the state domains, declared that he suspected it to be the *barbone*, a disease which frequently affects cattle in Italy.

In the month of November, Dr. Schiess Bey, chief physician at the hospital at Alexandria, received a certain quantity of blood from one of the animals which died at Koubbeh, and devoted himself to investigation. The result of his investigation was that inoculation performed on rabbits and chickens had enabled him to reproduce the disease which raged at Koubbeh, with all its consecutive symptoms. It is a disease of microbes, which could be isolated and cultivated. When inoculated again they faithfully reproduce the disease above specified. These colonies of bacteria consist of minute spherical organisms, bearing some resemblance to those produced by cholera of chickens, while the carbuncle bacteria have the form of little rods. The disease was arrested by the measures adopted against the carbuncle.

The following is a translation of a letter transmitted to the director of the sanitary service and public health department of Egypt by the chief veterinary inspector of the Government:

"CAIRO, *November 26, 1890.*

"MR. DIRECTOR: I have the honor to send you a statement concerning the disease of camels known under the name of *aya el debbane*, or fly disease.

"It is reported that camels, especially during the months of March and August, are stung by a fly while they are drinking water at some ponds or *birkets*. It is supposed that the virus from the sting remains latent during a period extending from six to twelve or eighteen months; then the beasts which have been stung show the following symptoms, viz: Inappetency, irregular and accelerated and sometimes difficult breathing, bristling hair, urine of a peculiar odor, which is considered as a very diagnostic symptom, and costiveness. On post-mortem examination the flesh is found to have a pallid appearance; deposits resembling white cheese, and also cysts containing a liquid substance, are discovered in the lungs and in the liver.

"Camels born in the neighborhood of infected ponds are less liable to the disease than new arrivals. Camels which have been at one time affected by it and which have been cured are pretty safe afterwards, for it appears that the disease attacks them only once during their lifetime.

"All these facts were communicated to me by Bedouins and by camel-drivers of Mex, near Alexandria, and of Fayoum. Some camels that were suffering from the disease were brought to me, and I had then a favorable opportunity for making an autoptical examination. The symptomatical signs of the disease were immediately recognized by the Bedouins.

"In consequence of my own observations, I think that such a disease of camels is not caused by flies which swarm over infected ponds, but that it is produced by the water which contains eggs of the *Ecchinococcus veterinarum*. These eggs are introduced in the system, forming cysts in the liver, lungs, or brain of the animals, which occasion more or less dangerous disorders according to the parts where they become fixed. The worm, when developed entirely, resembles the *tænia veterinarum*, which very often affects dogs and probably also jackals and wolves. Therefore if camels drink water from ponds contaminated by the excrements of dogs containing the eggs of the said tænia, they catch the disease which the natives attribute to a fly. Moreover, the parasite is not peculiar to camels, but other animals and even men are subject to the disease, if they drink water contaminated by dogs, etc.

"I would advise the owners of camels, as well as of other animals, not to let their beasts drink at any ponds or birkets, and more particularly at those situated near villages or camps of Bedouins where dogs are kept. Butchers ought also to be forbidden to feed dogs with meat of diseased animals, and no dogs ought to be allowed to enter slaughterhouses or places especially used for the slaughter of animals. Such precautions, if they were adopted, would save a great number of animals from disease. Mr. Piot, in a report read before the Egyptian Institute, in the month of June last, suggests that it is possible that the disease is not caused by a fly, but that it is due to a parasite.

"The treatment of diseased animals should consist in abundant and good nourishment, and in tonics, in order to fortify them against the invasion of the parasites."

LIBERIA.

Alexander Clark, Monrovia, Liberia, under date of January 10, 1891, writes:

There are no cattle or salt meats exported from Monrovia or any part of the republic of Liberia. Indeed, live stock of all kinds are of a very inferior kind; the cows weigh from 400 to 500 pounds, giving from a pint to a pint and a half of milk. Sheep and goats are small, weighing from 20 to 50 pounds, hogs weigh from 1 pound to 125. Chickens are small. No horses in the country, or at least in Monrovia.

MADEIRA.

John F. Healey, United States consul at Funchal, Madeira, writing under date of February 19, 1891, says:

I made inquiries of the proper authorities here, and, after some delay, with the following result:

Contagious diseases which occur and are inimical in this district are:

1st. Carbunculo bacteridiano amongst sheep and cattle.

2d. Distomatose amongst cattle. Other diseases of a contagious character, which at times manifest themselves, assume always a sporadic form.

The diseases indicated as recurring in this island and that of Porto Santo do not prejudice in any manner whatever the cattle trade.

QUEENSLAND, AUSTRALIA.

George T. Baggs, United States consular agent at Newcastle, New South Wales, under date of February 21, 1891, forwards copy of a letter from P. R. Gordon, chief inspector of stock, Queensland, concerning contagious diseases among cattle, sheep, and swine, as follows:

The only infectious or contagious disease known among the live stock of Queensland is pleuro-pneumonia in cattle. This disease has been more less prevalent in the colony since 1864. On its first introduction it was virulent, and the losses in cattle heavy, in some cases 20 per cent. Of recent years, however, it has assumed a very mild type, and less than 2¼ per cent succumb to it.

Inoculations by means of subcutaneous virus, cultivated through calves, has proved such a complete prophylactic that the disease is now easily controled. I inclose the report of M. Pasteur's representatives on this subject.

Tuberculosis and actinomycosis are prevalent to a small extent in cattle, particularly on the coast watershed, but neither of these diseases usually comes within the meaning of the terms "infectious" or "contagious."

The sheep in the colony are entirely free from every form of disease. Scab has never been known in Queensland since it was formed into a separate colony, nor for several years previously.

Worms in sheep are a local affection, depending on meteorological conditions.

The only disease in horses is a skin disease, caused by a regatoid parasite of the nature of ringworm; is, in fact, confluent ringworm, and, although difficult of eradication, scarcely affects the health of the horses in any degree.

Swine diseases of any description are totally unknown in the colony.

NEW SOUTH WALES, AUSTRALIA.

G. W. Griffin, United States consul at Sidney, New South Wales, Australia, writing under date of February 13, 1891, reports:

Diseases in horses.—Anthrax: Very rare. *Influenza:* Occasional outbreaks at considerable intervals. *Australian springhalt:* Very few cases. (See copy of report of Mr. Stanley, Government Veterinarian.) *Strangles:* Occasional outbreaks and as a rule of a very mild character. *Prurigo:* A few cases in the northeastern portion of the colony. (See copy of report of Mr. Stanley, Government Veterinarian.)

Diseases in cattle.—Pleuro-pneumonia: Occasional outbreaks in different parts of the colony, which are checked by inoculation. *Tuberculosis* and *actinomycosis:* Occasionally seen. *Anthrax:* Is rather widely distributed, but comparatively few cattle are affected. *Symptomatic anthrax,* or *blackleg:* Occasional cases in the colder parts of the colony. *Cancer:* A few cases. *Red water:* Periodic outbreaks in the eastern portion of the colony. *Ophthalmia:* Occasional outbreaks.

Diseases in sheep.—Scab: None. *Anthrax:* Prevalent in some parts of the colony at certain seasons. *Foot rot:* Prevalent in some districts in wet seasons. *Fluke:* Prevalent in the upland portions of the colony. *Parasitic worms:* Prevalent in wet, warm seasons, chiefly, of course, in the upland parts of the colony.

PHILIPPINE ISLANDS.

Alex. R. Webb, United States consul, Manila, Philippine Islands, under date of February 23, 1891, reports as follows:

Although there are no cattle, sheep, nor swine exported from the Philippine Islands, and while this country is not included in the list of countries mentioned in the letter of the honorable Secretary of Agriculture, dated December 13 last, calling for information relative to the diseases prevalent among domestic animals, it may be of interest to the Department of Agriculture, as well as to importers of cattle and hides, to know what ailments afflict the animals of this archipelago, and their general condition.

The Government issues no bulletins upon the subject, and the only sources of information are the newspapers, which are prevented by the Government censor from saying anything calculated to injure trade or reflect upon the management of public affairs, and those few persons who are interested in the raising and importation of cattle, sheep, and swine.

The cattle-raising industry is not followed extensively nor in a systematic manner, nor under improved, scientific methods, and all the animals raised for food are the offspring of importations from Australia, China, and the Caroline Islands. Domestic animals are raised, to some extent, by the more industrious natives, but the latter, who live in the rural districts, where animals can graze, are, as a rule, poor and improvident, and seldom have more than two or three carabaos and a half-dozen pigs. The presence of a milch cow or a sheep about the premises of a native is evidence of a degree of opulence calculated to excite the envy of the whole neighborhood.

The Manila market is supplied with beef from the herds grazed or raised on the island of Leuzon, in Masbate, the North and South Camarines, and Zambales. These herds are the property of well-to-do Spaniards or Mestizos, who import them solely to supply beef for the European residents and others who can afford to pay an extravagant price for it. The animals are Shorthorns and mixed breeds, and are imported and fed solely with a view of producing beef; it is not considered a profitable investment to keep a milch cow, as the gains from the sale of the lacteal product would hardly pay the expense of feeding the animal. When the beef cattle leave their grazing grounds they are generally in good condition, but by the time they reach the slaughterhouses of Manila they are usually in a very wretched state, and in almost any other country would probably be considered unfit for human food. As there is no way of bringing them to the city overland they come in the coasting vessels, closely packed, and, necessarily, poorly cared for; the hurried drive through the hot and dusty streets of the city, and the cruel prodding of the native drivers leave them feverish, gaunt, and weak, and their flesh soft and flabby. It seems highly probable that some of these animals may be suffering from contagious disease when they arrive in the city, but as there is no system of Government inspection, and as the animals are rushed to the slaughterhouses and killed at once, it is impossible to ascertain what their condition really is. All the hides of beef cattle are cured here and worked up, none being exported.

There are a few sheep raised in the provinces, where fresh mutton is a luxury, but they are killed for local consumption and seldom find their way to the Manila market. They thrive, apparently, and, owing to their scarcity, no contagious disease has attracted attention enough to cause an item in the papers. The majority of the sheep which supply this market with mutton come from Hong Kong by steamer and are killed soon after landing. Mutton is scarce and brings an average price of 37½ cents a pound; frequently it is not to be had in the markets at any price. It would be natural to suppose that this fact would encourage the raising of sheep in a country where, it is said, these animals thrive, but it has not had that effect thus far. This is due to the peculiar social and economic conditions prevalent; the natives are not disposed to engage in any branch of husbandry, and, even if they had the money to stock sheep ranches, would prefer an industry requiring less labor and involving less risk. The Spaniards are, as a rule, employed by the Government, and the other Europeans consider trade the safest, as well the most respectable occupation here. The native persistently cherishes the idea that the more property he has and the harder he works the more taxes he will have to pay and the more liable he will be to become the prey of petty official sharks, and, therefore, he is content with his squalid hut and a little patch of ground sufficient to afford him the barest necessaries of life. The trade in sheep and mutton is almost exclusively in the hands of the Chinese, and the European who employs a native cook rarely has chops for breakfast or enjoys the odor of mint sauce. One of the chief recommendations of the Chinese cook is that he can get mutton occasionally.

Every native who can buy a pig keeps one or more, which usually furnishes his family and friends with the dinners which are considered indispensable during the Christmas holidays. Whenever he has more than he needs for this purpose he sells one or two in the market in order to procure other household supplies. But there are no large herds of swine to be found, and contagious diseases are rarely, if ever, heard of among this class of domestic animals.

The principal sufferers from contagious diseases are the carabaos or water buffalos, which are cheap and plentiful and which are the only animals used for drayage and other heavy work to which oxen are usually devoted in other countries. They are also eaten by the natives, and the females furnish nearly all the milk sold on the streets of the cities and towns. Their hides, hoofs, horns, and bones are exported in large quantities, the United States receiving a share of the hides and hide cuttings.

In the spring these animals are frequently afflicted with a throat disease, known here as "gargantina," which, it is supposed, is caused by a very small worm that feeds upon the young grass and which burrows in the membranes of the throat and lungs of the animal, breeding there and causing a painful running sore which generally proves fatal. When the ailment first manifests itself it is quite an easy matter to check its spread by the use of the native remedies, but if it is allowed to gain much headway the animal refuses to eat, discharges a thick, white mucus from the mouth and nostrils, totters unsteadily in its walk, and finally lies down to die. The natives believe that as long as it can be kept upon its feet there is a chance of saving the victim, but when it lies down it will never arise again. This disease is not contagious and does not affect the hide. No other animals are afflicted with it except horses, which, however, seldom die of it.

Three years ago, about the beginning of the rainy season, in June, the carabaos, as well as the beef cattle, where attacked by a disease almost identical with epizoötia, which was called cholera by the natives. It was so called because a number of natives who ate the flesh of carabaos killed while suffering from it were attacked by a disease closely resembling cholera, which invariably proved fatal. The symptoms manifested by the animals were clearly those of epizoötia. The disease was contagious and large numbers of carabaos and beef cattle perished. These were, as as rule, buried or burned, and the natives were strictly prohibited from selling or using their hides or any parts of them.

For the past two years the cattle of the archipelago have been in good health.

GREAT BRITAIN.

The annual report of the director of the veterinary department of the privy council of Great Britain for the year 1891 gives in detail the work of the board for the eradication of contagious and infectious diseases of domesticated animals during the year. The president of the board states that the attention of the department for the whole of the year was concentrated on the administration of the pleuro-pneumonia act of 1890 in all parts of the country where the disease existed. The prosecution of the work demanded the exercise of constant vigilance on the part of the officers of the department. It seems to have been foreseen, as it was by this department in its efforts for the suppression of the disease in this country, that the placing of large tracts of country under severe restrictions in regard to the sale and movement of cattle would seriously hamper trade and cause loss and inconvenience to owners of stock, and hence array strong opposition as to what the board regarded as a paramount duty. At the close of the first year the president of the board says that—

> It will be generally admitted that the success which has attended the procedure furnished the justification of the severity of the regulations which it was deemed expedient to enforce in certain scheduled districts, while the rest of the country was left quite free from restrictions.

He continues:

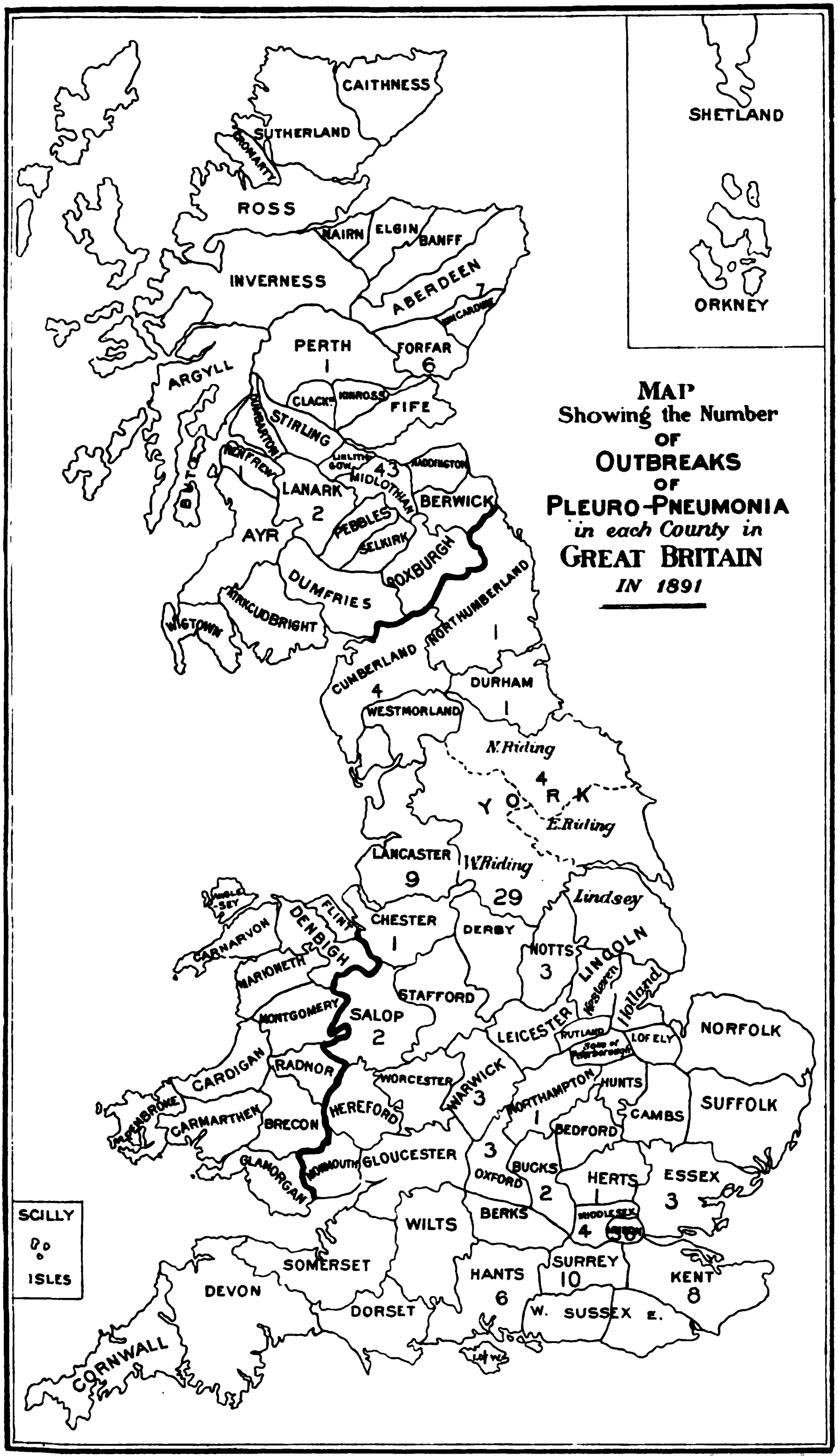
> In the supplementary report which was issued in December last, the history of pleuro-pneumonia was closely followed during the twelve months of the administration of the pleuro-pneumonia act by the board of agriculture from September 1, 1890, to August 31, 1891. The record of that period was one of steady progress toward the object in view, namely, the final extinction of the disease.
>
> At the commencement of the operations in September, 1890, forty-six outbreaks had to be dealt with during the month. This number was reduced to eighteen in the last month of the year, and the decrease continued during the first quarter of 1891. In the second quarter fresh outbreaks occurred, and in July the Southampton case led to extensive spreading of the disease, owing to the movement of cattle from that unsuspected center of infection.
>
> Another outbreak, which occurred in Cumberland, was also attended with the movement of infected cattle and consequent extension of the disease. The operation of the London (cowsheds) pleuro-pneumonia order of 1891, restricting the movement of cows out of the cowsheds in the district of London, led to the discovery of cases of pleuro-pneumonia which would otherwise not have been detected, and altogether the circumstances afford a sufficient explanation of the increase in the number of outbreaks to twenty-three in May, twenty-two in June, thirty-five in July, and twenty in August.
>
> Precautions were promptly enforced to deal with the recrudescence of the disease; animals were traced from the infected centers and slaughtered, and in a few weeks the mischief which had been done was repaired, but not without a serious loss of valuable cattle and the expenditure of a large sum of money.
>
> No event of any importance occurred during the remainder of the year 1891. In September the number of outbreaks fell to eleven, nine of which were in England and two in Scotland. In October there were seven outbreaks, five in England and two in Scotland. In November there were seven outbreaks, four in England and three in Scotland; and in December the outbreaks were six in number, of which three were in England and three in Scotland.
>
> Wales remained free from the disease during the year.
>
> In the report of the assistant inspector the details of outbreaks in different parts of the country are given. It appears that the outbreaks were limited to 27 counties, whereas in 1890 there were 36 counties infected. The total outbreaks in 1891 amounted to 192, most of which occurred in the counties of Lancaster, London, Midlothian, Surrey, and the West Riding.
>
> In reference to the prevalence of pleuro-pneumonia among different classes of cattle, it has often been asserted that the disease is most common in milking cows, and the experience of the last two years amply justifies the statement.
>
> The returns of the cattle slaughtered by the order of the board of agriculture show that 72.3 per cent of the diseased animals were cows or heifers. Only 1.3 per cent were bulls. Other cattle over 1 year old amounted to 19.2 per cent, and 7.1 per

cent were under 1. These figures prove that pleuro-pneumonia is more frequently present in dairy cattle than among other classes—a fact which may, to some extent at least, be due to the very favorable conditions for the spreading of disease which are present in a large proportion of the places where cows are kept, whether in town or country.

Pleuro-pneumonia can not be caused by insanitary surroundings, but when disease has been introduced among a herd by the agency of a living diseased animal, the close association of a number of cows in a badly ventilated shed must favor the spreading of the disorder; besides which, it is at least probable that the artificial conditions under which cows are kept have led to the development of a predisposition which renders them specially susceptible to the malady. At any rate, there is good evidence that the popular idea of the cow shed being the chief source of danger is not without justification.

Tuberculosis, anthrax, and swine plague existed in a number of localities. Some experiments were made with tuberculous milk for the purpose of ascertaining to what extent, if any, the products of animals affected with tubercle were infective when given as food in the raw state to other susceptible animals.

The accompanying map shows the number of outbreaks of pleuro-pneumonia in each county in Great Britain during the year 1891:



MAP
Showing the Number
OF
OUTBREAKS
OF
PLEURO-PNEUMONIA
in each County in
GREAT BRITAIN
IN 1891

Sackett & Wilhelms Litho. Co. N.Y.

SUPPOSED MALADIE DU COÏT AMONG HORSES IN NEBRASKA.

Hon. J. M. Rusk,
Secretary of Agriculture:

Sir: I have the honor to make the following report of my investigations of a disease among horses in northwestern Nebraska:

In accordance with instructions, dated April 30, 1892, I proceeded to Sheridan County, Nebr., arriving at Rushville, May 8, 1892. Owing to storms it was impossible to do any work until May 11. A history of a few cases will show the various stages of the disease.

Case 1.—Black stallion, 8 years old, the property of M. Swigert & Co., of Gordon, Nebr. Horse by Brilliant. This horse was sold by Mr. Dunham, of Illinois, as a 2-year old, to parties near Bloomington, Wis. He was brought from Bloomington to Gordon, Nebr., with four or five other stallions, intended for the Indian agency of Pine Ridge, S. Dak., by Mr. J. Newmann, and was purchased by Swigert & Co. about December 30, 1890. The balance of these horses are now on the Indian reservation.

From all accounts this horse appeared perfectly well up to about the 1st of June, 1891. I secured the service book, so that I could trace the mares that were served by him. His record seems to have been carefully kept until about the 1st of September, when he appeared to be in bad "condition," after which time he was only bred to returned mares. About the 1st of June, 1891, the horse began to show symptoms of disease. Mr. Swigert gave me the following statement in regard to the horse, and his statement is corroborated by several parties who bred their mares to him:

The animal appeared in very fine condition. He was more amorous than usual, but found great difficulty in serving a mare. Erection seemed to be incomplete, although the glans penis was much larger than usual, and in many cases service was not completed. The sheath became slightly swollen (œdematous), but the swelling would disappear with exercise. The testicles did not seem tender, but no particular attention was paid to this point. During the winter the horse had an attack of what was supposed to be distemper; discharged a great quantity of matter from nose and eyes; submaxillary gland swollen and tender; eyes weeping. At this time the skin began to turn white about the nose and eyes; the sheath became œdematous, the swelling extending along the abdomen nearly to the fore limbs. This swelling gradually subsided, and the skin over the sheath, scrotum, and up the perineum to and surrounding the anus became covered with white spots, which gradually coalesced until the whole region became a uniform pinkish white (previously had been black). At the same time the penis, from the glans up, became white.

At the time of this attack of "distemper" the horse was very "sore across the back" and "staggered behind," as his owner said, "and knuckled at the fetlocks." He lost flesh rapidly, but, at any time during the most of his sickness, seemed as amorous as ever. During the winter there appeared over the body, particularly behind the shoulders, quite regularly circumscribed swellings, varying in size from a pea to a walnut, which seemed to itch badly, and which left as suddenly as they appeared.

At the time of my visit I found this horse showing symptoms as follows: Standing in his stall feeding; respiration, normal; pulse, 34, full and soft; temperature, 98$\frac{2}{5}$°; skin, about nose and eyes and over penis, sheath, and scrotum, showing the papery white condition described above; sheath now slightly thickened, not œdematous; appetite capricious; movements irregular as from weakness; knuckles over at fetlocks and has difficulty in straightening the leg when flexed. No lameness or soreness. In the creases in the skin around the scrotum and between the thighs is a slight deposit of brownish red sebaceous matter. Over the surface of the penis immediately above the glans and near the prepuce are numerous small reddish purple spots, varying in size from a pin head to a wheat grain. These do not appear like small ulcers, but rather like discolorations. I could not find in this case any evidence of ulceration. The sebaceous secretions in the sheath seemed greatly increased in quantity, and the penis covered with minute white scales, hard and dry in character. Although frequently cleaned there is a peculiarly offensive odor from the penis.

Case 2.—Sorrel mare, known as the "Obe Church mare," aged 8 years, bred to Swigert's horse May 22, and rebred June 5. A short time after being bred the last time she "began to get weak across the back;" was tender over the lumbar region; vulva swollen until even with the buttock. Acted as if in continual heat, and had a slight glairy white discharge from vulva. There was an œdematous swelling under the abdomen, involving the mammary glands and extending to the umbilicus. As the swelling of the vulva began to subside, the skin, which had previously been black, began to turn white in spots, the spots running together until now the whole vulva and anus are perfectly white. From the first appearance of the disease until the symptoms subsided the mare acted as if in heat continually. At present she has the appearance of having completely recovered, except the discoloration of the vulva.

Case 3.—Gray mare, aged, the property of Mr. Bealey. This mare was bred to Swigert's horse on the 29th of May. About the 1st of June she began to show symptoms of disease. "At first she simply began to get weak across the back." As the disease progressed she was unable to rise without assistance. There was a muco-purulent discharge from the vulva; œdematous swellings showed under the abdomen, and great emaciation and prostration followed. Appetite remained good. Vulva became spotted white, the spots *not* confluent, as in case 2. At present this mare is weak and does not seem to thrive well, but seems to be gaining in strength.

Case 4.—Gray mare, aged, property of David Moffatt. Bred to Swigert's horse May 28. About ten days after service she was noticed to be weak. Seemed to feel well, but was hardly able to rise when down. No discharge noticed from vulva, but appeared as if in continual heat. At the time of my visit this mare had been sick about a year. She is very sore along the lumbar region, and is emaciated and out of condition. Appetite good. Respiration, pulse, and temperature normal. Vulva along the edges of the labia and in spots over the surface a chalky white. Clitoris somewhat thickened and rigid.

Case 5.—Gray stallion, 8 years old, grade Percheron, property of H. Hollins, 12 miles from Gordon. This horse appeared in fairly good condition. Could not get a satisfactory history of the case. Owner says the horse had never shown any trouble. I found the horse very foul, and the same peculiar odor as noticed in Swigert's horse. The testicles seemed tender upon manipulation, but there was no marked soreness. The sheath and scrotum show numerous small white spots about the size of a split pea. On the penis just below the prepuce and surrounding the organ was a row of small white scabs. Upon detaching these scabs there appeared small ulcerated pits with whitish centers and ragged edges. Penis covered with a dry scurf. From the appearance of this horse I cautioned the owner against using him for breeding purposes, and advised that he be put to farm work. On May 27 I was called upon by a Mr. Palmer, in Gordon, to examine this same horse. It seems that Mr. Hollins, after my previous examination of the horse, had sold him to Mr. Palmer for breeding purposes. At this time I found that the small ulcers noted above had given place to confluent white spots, and the same peculiar reddish purple discolorations were seen above the glans as noted in Swigert's horse.

Case 6.—Small bay mare, aged, the property of J. H. Miller, near Gordon. This mare was bred to Swigert's horse June 9, 1891, and was rebred June 29. She began to show the disease within a day or two from the time of second service. Mr. Miller states that the mare was served three times, but the stallion's book only shows twice. Mr. Miller states that the first symptoms noted were frequent straining as if trying to urinate, and that she appeared continually in heat. In about three or four weeks there appeared a glairy, whitish discharge from the vulva. The mare lost flesh and showed tenderness over the lumbar region, with uncertain movements in the posterior limbs. At the present time the mare appears emaciated, has slight chronic laryngitis, slight discharge from nose, the vulva covered with white spots extending up to and involving the anus; clitoris very much enlarged and projecting one-half inch beyond the labia; the mucous membrane of the vagina dark red, with lead-colored streaks. At the lower commissure there are several small red ulcers with rigid edges. No enlargement of the lymphatics could be noticed.

Case 7.—Sorrel mare, 7 years old, property of Philip Mosser, 9 miles from Gordon. Served by Swigert's horse May 13 and June 3, 1891. First showed symptoms of disease immediately after last service. The first symptom Mr. Mosser noticed was extensive swelling of the vulva. In about two weeks there was a discharge of glairy, whitish pus from the vagina, accompanied by extreme irritation, with frequent attempts to urinate. About this time white spots began to show on the vulva. Mr. Mosser began treatment by vaginal injections of an astringent lotion. The mare began to improve and he bred her afterward to a horse in Rushville, which horse has been sold out of the State. This mare is now heavy with foal from this last service. The only evidences of disease I could detect were the white spots on the vulva, and very frequent, almost continual, attempts to urinate.

Case 8.—Black mare, 8 years old, property of L. W. Barnum. Bred to Swigert's horse May 20 and June 11, 1891. The first symptom noticed by Mr. Barnum was "a soreness over the back," accompanied by œdematous swelling along the abdomen, involving the mammary glands and accompanied by extensive swelling of the posterior limbs. Along the inside of the thighs and over various portions of the body numerous small, circumscribed swellings appeared. Some of these broke and discharged for a few days and then healed rapidly. There was no discharge noted from the vulva, but the previously black skin of the vulva began to turn white. The clitoris in this case is somewhat enlarged, but not to the extent of the Miller mare.

Case 9.—Small gray mare, aged, property of Andrew Sitt. Served April 6 and 27, May 13, and June 4, 1891, by Swigert's horse. After the last service the mare began to fail. There did not seem to be any well-marked symptoms, as noticed by the owner, except that, though her appetite remained good, she did not thrive. She failed to get with foal by any of these services and seemed to be continually in heat. She was afterward, on July 20, bred to a gray stallion belonging to Mr. Peter Nelson, and failing to get with foal was later served by a black horse belonging to the same person.

At present this mare is thin in flesh; has slight watery discharge from both nostrils; submaxillary lymphatic glands enlarged. No discharge from vulva, but the surface of the vulva covered with numerous white spots; clitoris somewhat enlarged and protruding. Mucous membrane of vagina dark colored, showing numerous reddish-purple spots about the size of a wheat grain. In the creases about the vulva the same reddish-brown deposit was noticed as described about the scrotum of the Swigert stallion.

Case 10.—Dark gray grade Percheron stallion, property of Peter Nelson, 5 miles from Gordon. Mr. Nelson says "this horse never showed any trouble until after he had served Andrew Sitt's mare." This was July 23. From Mr. Nelson I learned that the first and only symptom he has ever seen in this horse was an œdematous swelling of the sheath and scrotum. The horse has remained in good condition and was, if anything, more amorous after the swellings first showed, but failed to get his mares with foal. He has not been used this season. I found extensive doughy swelling of the sheath and tenderness of the testicles. The penis was covered with dry yellowish-white scales, and the organ itself was white in color. I recommended that this animal be put to work, and the owner is now using him in a breaking plow.

Case 11.—Black stallion, 8 years old, grade Percheron, property of Peter Nelson. Served Andrew Sitt's mare about August 17. Shortly after the horse began to lose flesh rapidly. The sheath and scrotum swelled enormously, the swelling extending along the abdomen between the fore limbs and each side of the body. There was a considerable watery discharge from the eyes and nose, with frequent attempts to urinate. Urine scanty and dark colored. Appetite capricious, though as a rule good. At times there was a troublesome cough, accompanied by great hoarseness, the animal being almost unable to neigh. At all times, however, the horse appeared as amorous as ever, although erection was not perfect. At the time of my visit I found this horse greatly emaciated; appetite ravenous. Under the abdomen, extending from the fore legs and involving the scrotum, an enormous œdematous swelling as large as a man's body. Strangely, this swelling does not interfere with the free passage of the penis. A slight chronic laryngitis. No swellings along the lines of the lymphatics. Penis white in color. No evidences of ulceration.

Case 12.—Sorrel stallion, 4 years old, property of W. Young. This horse does not show well-marked lesions of disease, and is working regularly in the field. When standing, the sheath, scrotum, and posterior limbs swell badly. Swelling subsides with exercise. Respiration accelerated. No ulcers to be found, but the penis and prepuce chalky white. The horse is not being used in the stud this year.

Case 13.—Bay mare, 4 years old, grade Clyde, property of Laban Moss. Bred to Swigert's horse June 12. Began to show symptoms of disease about last of July. First symptoms noticed were extensive swelling of the vulva, with a muco-purulent discharge which covered the thighs and matted the tail. This discharge has kept up to the present time. At the time of my visit I found the following symptoms: Extreme emaciation and weakness; abdomen tucked; respiration quickened and, upon horse being moved, very difficult; chronic laryngitis, with soreness upon pressure; apparently spasmodic contraction of the glottis upon sudden movement; pulse weak and irregular; temperature 98$\frac{3}{5}$°. At the owner's request this mare was shot for post-mortem examination. I opened both the abdominal and thoracic cavities by removing the entire left side.

Abdominal cavity: Lymphatics of the mesentery enlarged, varying in size from a Lima bean to a walnut, particularly along the curvature of the colon and cæcum. Several lymphatic glands on the cæcum were swollen, with large necrotic centers. The stomach was filled with grass and contained a large number of "bots." The duodenum was distended just beyond the pyloris to 4 or 5 inches in diameter, and was almost occluded with "bots." Remaining small intestines normal. The apex of the cæcum was inflamed and thickened, showing numerous small ulcerated spots. Other large intestines normal. Uterus flabby. Mucous membrane indurated and more or less covered with yellowish-white, muco-purulent, catarrhal exudate. Os open.

The mucous membrane of the vagina was dark red in color; otherwise the organ was normal.

The left ovary was 3½ inches in diameter and hard upon pressure. On section found to be made up of numerous pockets filled with a straw-colored fluid. The walls of these pockets were from one-eighth to one-fourth of an inch thick. The hard feeling noted above was found to be due to its distension with fluid. The right ovary was about 3 inches in diameter, showing a large hemorrhagic clot on its surface about the size of a silver dollar. On section this clot extends completely through the ovary. Bladder, normal.

In the thoracic cavity the mucous membrane of the larynx was found thickened, and the glottis and epiglottis covered with small confluent ulcers, these ulcers showing ragged edges.

With the implements at hand it was impossible to remove the brain and spinal cord.

Case 14.—Gray mare, 8 years old, property of Andrew Lowe, 4 miles from Gordon. Bred to Swigert's horse April 14, 16, and June 1, 1891.

The symptoms in this case developed gradually, the mare being worked to within a month or two of my visit, May 16. There was a slight discharge from the vulva, with frequent attempts at urination. About the 1st of April, 1892, the mare became suddenly extremely weak, with great difficulty in breathing upon being moved. Two or three times had "choked down" in harness, and afterward, when turned on pasture, would show the same symptoms upon being suddenly moved. At the time of my visit I found the animal on good pasture, greatly emaciated and weak. Appetite, ravenous. Small white spots covering the vulva and a whitish discharge from the vagina. Respiration difficult. No swelling over the larynx, but great tenderness upon pressure, the slightest pressure causing hoarse, difficult cough. On May 20 the mare died, her owner saying "she choked to death." Post-mortem eighteen hours after death. The animal lying upon the left side, I removed the entire right side, exposing the entire abdominal and thoracic cavities.

Abdominal cavity: The organs of the abdominal cavity were all in a normal condition except as follows: The lymphatic glands of the mesentery and along the curvature of the colon and cæcum were enlarged, varying in size from a Lima bean to a walnut, some of them showing necrotic centers. The uterus was thickened, considerably enlarged, hard, and fibrous to the touch. The mucous membrane was from a sixteenth to an eighth of an inch thick, and completely bathed in a thick white glairy catarrhal exudate. Surrounding the os and studding the surface of the uterus, depending from the folds of the mucous membrane, were a great many bunches of almost clear gelatinous deposit, which, upon removal, left a clear, smooth surface. In the vagina the mucous membrane was slightly inflamed, showing near the external opening several small reddish purple spots. The clitoris was enlarged and slightly protruding. The vulva was swollen, œdematous, and covered over its external surface with white spots.

The organs in the thoracic cavity were normal.

The glottis and epiglottis were greatly thickened and covered with small dark-reddish ulcers with ragged edges.

Owing to want of instruments, I did not attempt to examine the brain or spinal cord.

Case 15.—Chestnut sorrel mare, 7 or 8 years old, the property of J. N. Morey, 14 miles from Gordon. This mare is one of 9 bred to an imported Percheron horse belonging to Mr. John Eldridge. She was bred to this horse early in the season, but failed to get with foal. Six of the other mares are with foal, or have colts by their sides, and are all right. In October the chestnut mare was taken by Mr. Morey's men into the sand hills, 50 miles from Gordon, to put up hay. While she was there she was in heat, and got with a herd of range horses belonging to a Mr. Beckwith. About three weeks after this service the mare began to show a watery discharge from the vulva, which changed to muco-purulent in character. The mare became "short-winded," "weak across the back," "eyes ran," and within a month of this last service white spots began to show on the vulva, and have increased until now the whole vulva is perfectly white. This mare, while looking well now, is weak and unable to stand work.

I carefully examined the John Eldridge horse spoken of above, but failed to detect any evidence of disease, either in himself or in any mares that he served last season.

Case 16.—In order to trace the infection of the Morey mare, I visited the ranch of Mr. E. White, 50 miles southeast of Gordon. This ranch is where the Beckwith horses have been running for the last two years. I found here an iron-gray stallion, 7 years old, grade Percheron, the property of Mr. R. Beckwith. This horse is now at Mr. Beckwith's place on the Niobrara River, but last season was kept at the ranch, and is said by the herder to have served the Morey mare. This horse has been worked on the farm all the season, and is thin in flesh. I found on his scrotum two elongated sores covered with white scabs, which, upon removal, left raw, ulcerated surfaces. Scrotum and sheath fibrous. The inner folds of the sheath were covered with dark sebaceous material, which, upon removal, left a white surface. The penis was covered with a whitish scaly scurf, the whole organ being perfectly white. Horse listless and apparently weak. His herder says that only three or four of the mares got with foal last year, although this horse was running with them constantly. It was impossible to examine the mares.

They were wild range mares running loose upon the range, and scattered throughout the sand hills.

In order, if possible, to trace the source of this infection, I made careful inquiry regarding this horse. I find that he was raised near Gordon, and was turned on this range the first season he was in service. Mr. Beckwith informs me that he bought a team of mares, one bay and one sorrel, of Mr. F. Kilbourne, on the 17th of May, 1890. This team came from Wyoming, and the bay mare had a colt following her, which colt is all right now. These mares ran with this stallion during the season of 1890. Neither of them was with foal. On May 22, 1891, the sorrel mare was bred to Swigert's horse. Swigert and others present agree in saying that this mare had a copious watery discharge from the vulva; that she seemed to be in heat, but fought the horse viciously when he attempted to mount. After being served she was placed in a pasture belonging to Mr. Rexroth, where she remained until she died, about ten days afterward. The bay mare was placed in Rexroth's pasture May 22, with the sorrel mare, and was bred to Swigert's horse May 31. She was again bred June 17. Neither of the mares was taken from the pasture, except to be bred, from the time they were placed there, May 22, until after June 17, one of them meantime having died. Shortly after the service of the bay mare, June 17, she was taken from the pasture by Mr. Frank Black on a mortgage; was traded to one Mr. Potts, and shortly afterward died. Mr. G. A. Haywood, a market gardener, living near Mr. Beckwith, on the Niobrara River, drove this mare in the spring of 1891. He says that at the time he drove her she had a disagreeable discharge from the vagina, running down the inside of the thighs and matting the tail to such an extent that he told the owner, Mr. Beckwith, that she was "diseased in some way." Mr. Beckwith claims that Mr. Haywood drove the mare *after* she had been bred to Swigert's horse. The dates in the stallion's service book and the dates in Mr. Rexroth's pasture book show that one of these mares never left the pasture after having been bred, and that the other mare only left the pasture to be rebred, until taken out on mortgage and traded to Potts; so that Haywood must have driven her after Swigert's horse served her. Mr. Beckwith says that the same day he bought the team he bred the bay mare to a black Norman horse, belonging to Mr. Alexander Dobson, and afterward bred the sorrel mare to the same horse. Neither of them getting with foal, they were turned on the range and were served by the gray stallion noted as case 16. Dobson's horse appears to be all right. It is rumored in Gordon that several horses in the "sand hills" have "had something the matter with them" for two or three years. I could not locate these rumors further than the Beckwith horse.

There were two stallions standing in Gordon last year, known as the "Taylor horses," one a grade Clyde and the other a grade Percheron. These horses are reported to have been sick during the season, and to have been bred to several mares now showing this disease. One of these horses is dead. The other is said to have been sold to parties in Cherry County, Nebr., and to be on a ranch somewhere in the sand hills. I could not locate him.

It was reported that there were a good many horses belonging to different parties in the Indian Reservation in South Dakota that were diseased. In company with Dr. W. A. Thomas and Prof. C. L. Ingersoll, of Lincoln, Nebr., I proceeded to the reservation to inspect as many of their horses as possible. All the stock upon the reservation was running upon the range, and it was extremely difficult to get any of them rounded up for examination. I visited the Pine Ridge Agency and secured permission from the Indian agent, Capt. Brown, to visit various portions of the reservation. Anticipating my coming, Capt. Brown had corresponded with the various head farmers of the reservation, directing them to report to him any cases of disease among horses of which they might know. From these reports we found that Louis Shangra and Nicholis Janis, two of the largest stock owners in the agency, would be more likely to know of the trouble than any one else. Accordingly we drove to the ranch of N. Janis, situated on the White River, S. Dak., about 90 miles from Gordon, Nebr. Mr. Janis brought into the corral about 50 mares from his and Shangra's herds. Some of these mares had been sick last year, but we could find no history, or any evidence of such disease as we found near Gordon.

The symptoms presented in this disease coincide with those found in horses in Illinois, which were pronounced to be affected with *maladie du coït*. There seems to be no doubt that the disease is communicated only by copulation, and while there is some difference in the symptoms from those noticed in lower altitudes, these differences can all be accounted for by climatic conditions. The Nebraska plains, having an elevation of about 4,000 feet above sea level, their consequently dry pure atmosphere tends to prevent the suppurative changes likely to occur in a lower altitude.

The State of Nebraska, I am informed, can do nothing toward eradicating the disease. The last legislature failed to appropriate any money to carry on the work of the sanitary commission, or to pay salaries of State veterinarian and assistants. While the State has ample law, there is no money to enforce it. The farmers and stock raisers are doing what they can to prevent the spread of the disease by not breeding; but, as is to be expected, the mares, especially some of them, are being traded to other parties. Some are reported to have been sent out of the State as far as Indiana and Iowa.

I am of opinion that all the infected horses do not now exceed 200 head. These are confined mostly to individual mares belonging to farmers near Gordon, with possibly some mares among range horses near there, and to stallions that are, for the most part, kept up in stables. Most of these stallions are grade Percheron. Most of the mares are common range-bred mares, or are graded from them.

Very respectfully,

GEO. C. FAVILLE,
Veterinary Inspector.

BALTIMORE, MD., *June 10, 1892.*

CATTLE AND SHEEP INDUSTRY OF COLORADO.

Hon. J. M. Rusk,
Secretary of Agriculture:

SIR: I have the honor to herewith submit a report on the number of cattle and sheep in the State of Colorado, by counties, alphabetically arranged, together with such other information touching the live-stock industry of the State as I believe will be useful to the Department and of value to the public.

The abundant rains during the summer and fall months covering that portion of the State known as the plains counties, and the heavy fall of snow of last winter in the mountain regions surrounding the valleys in the higher altitudes, resulted in a luxuriant growth of grass covering the entire stock-growing portion of the State. As a consequence of this favorable condition, cattle and sheep entered the winter months in much better condition than they have heretofore done for several years in the past.

But a few years ago the ranges were possessed by large cattle companies who were disposed to overstock the great natural pasture fields, in their greed to increase the number of their herds and flocks, that they might realize larger dividends upon the money invested in what was at that time the most lucrative business in the State. The range was thus crowded beyond legitimate bounds, and the industry drooped and withered to such extent that many sent their entire holdings of merchantable product to the markets, which naturally had a depressing influence on values. The remnants were closed out as speedily as possible.

While this condition reduced the numbers to an alarming extent, and temporarily depressed the price of the stock in the herds of those who remained in the business, it had the beneficial effect of relieving the feeding grounds of their burden and increased the food supply for those who could not, or did not care to, retire from the business, in which they had invested largely and to which they had given many years of valuable time. The latter class were not mere adventurers or speculators, but were building up and maintaining a legitimate business based upon proper methods. Since the close of this weeding out process, and during the last year, there has set in a reaction favorable to the stock growers. Prices have advanced perceptibly, the markets have been active and strong, readily absorbing all of the product sent to the yards for slaughter, while feeders have taken all the offerings sent out for that purpose at prices remunerative to the growers.

Many of the cattle growers have introduced into their herds full-blood or high-grade bulls, and have in this way greatly increased the average weight and commercial value of their animals. In this connection it may be well to state that my observation leads me to the conclusion that the best results are obtained from a cross with the Herefords and Galloways. With many, however, the Shorthorn is a leading favorite.

It is a matter of no little difficulty to arrive at the cost of producing cattle grown upon the range till they reach a merchantable age.

On examining the subject, and making inquiry of men who have been for many years successfully engaged in the business, and who have given the subject intelligent reflection, I must submit that where money is judiciously invested and the herds carefully handled, no business in the West returns a greater per cent upon the capital employed than is now being realized from the cattle industry of Colorado.

In large herds the average price of yearlings, at $10 per head, is probably a fair estimate of their value. The cost of caring for these, per head per year, is estimated at $1. Their maintenance for three years, on this basis, will be $3, at which time the market value of the males, or "steer cattle," upon the range can safely be placed at $35 per head, which, without loss in any form, will show a net profit of $21 per head. But from this must be deducted a loss from storms and other causes, which, estimated at 15 per cent, will leave a net profit of nearly $6 per head on an investment of $10. This estimate, it must be recollected, includes only the male or "steer cattle" of the herd. The females, or "cow cattle," present another phase of the cattle business, and can not be figured on the same lines of profit and loss as that above treated.

About 33 per cent of the heifers will drop calves at the age of 2 years, 50 per cent at the age of 3 years old, and this per cent will carry through the remainder of the life of the cow, that being an average of 10 years. When her usefulness ceases, after that age, the female stock have little value. They are either disposed of at nominal figures, or held with the hope that they may produce another calf, which will pay for their keep for the remainder of the time they live, and the chances on profitable results are about even in either event.

On this estimate, which is based upon the experience of one of the foremost range herd owners in the State, the product of the female stock is four calves in nine years, net, valued at $10 per head. Loss is deducted from this calculation.

The cattle in the counties of Weld, Larimer, Fremont, and Jefferson aggregate about one hundred thousand, and are principally owned by farmers who rely upon pastures of timothy, clover, and alfalfa for subsistence during the summer season, and hay cut from the meadows for winter feeding. In these counties the loss from storms is nominal and the profits greater than in counties where the range is the only reliance for feed during the entire year.

The numbers given and their value in the tabulated statement is taken from the assessors' books in the several counties. As to numbers, they are, no doubt, as accurate as can be given, but the value assessed will bear an increase of at least 50 per cent without reaching beyond the limit of actual cash value.

No disease has broken out in the herds or flocks of the State during my term as stock correspondent, which fact can safely be attributed to the strict quarantine regulations adopted by the Bureau of Animal Industry, and so vigorously maintained by the Hon. J. M. Rusk, Secretary of the Department of Agriculture.

No storms have prevailed thus far during the winter that have caused losses on the range or farms.

There were received at the Union Stock Yards at Denver during the year 1891, 140,973 cattle and 165,616 sheep. Of this number there were shipped to points outside the State 96,384 cattle and 101,289 sheep.

The number of cattle sold for domestic use to butchers was 43,756, and of sheep 64,025. Pueblo is the only point, except Denver, where stock yards are maintained that keeps a record of the receipts and shipments of stock.

The sheep industry does not cover as wide an extent of territory in the State as is occupied by the cattle business. It is confined to the plains counties east of the front range of mountains, and to the valleys in the southern portion of the State where the climate is more favorable than in the valleys of the higher altitudes, except in cases where sheep are shipped in from Utah and ranged on the grasses growing on the mountain sides during the summer season, and in the fall are sent forward to the States of Nebraska, Kansas, and Missouri for winter feeding or sold for mutton in the farther Eastern cities. Thousands have been shipped into the State during the last summer which do not figure in the tabulated statement.

The flock-owners range their sheep on the natural pasturage throughout the entire season, and provide neither hay nor grain for their subsistence. Owing to favorable rains the pasturage was unusually good for the year just ended, and the flocks are vigorous and healthy. The average clip per head last year is estimated at 6½ pounds. The price per pound has ruled at about 15 cents. All the wool is marketed unwashed. This returns a net of over 90 cents per head, with an expense account of cost of herding and clipping which is more than covered by the lamb product of the flock. The amount of wool produced in the State during the past season was 5,088,000 pounds.

Number and value of cattle and sheep in the State of Colorado in 1891.

Counties.	Cattle.		Sheep.	
	Number.	Value.	Number.	Value.
Arapahoe	19,186	$152,055	52,904	$53,105
Archuleta	3,324	37,556	2,882	3,040
Baca	17,277	138,605	11,030	11,530
Bent	17,583	134,878	14,114	15,331
Boulder	15,654	125,300	354	357
Chaffee	4,612	51,034	9	9
Cheyenne	4,056	30,656	7,600	7,600
Clear Creek	1,100	16,423	....	....
Conejos	7,755	56,509	12,284	11,308
Costilla	7,384	63,792	7,704	7,704
Custer	11,171	113,461	29	42
Delta	15,851	134,952	2,300	2,300
Dolores	3,300	27,124	....	....
Douglas	11,782	106,136	....	....
Eagle	8,918	102,708	42	65
Elbert	17,902	179,860	52,787	81,300
El Paso	33,941	300,070	54,080	54,080
Fremont	16,433	135,040	....	....
Garfield	20,275	177,910	4,450	6,675
Gilpin	9,957	16,581	....	....
Grand	8,286	93,011	36	82
Gunnison	12,118	107,990	3,166	3,166
Hinsdale	924	8,975	....	....
Huerfano	13,824	94,939	52,608	48,786
Jefferson	11,485	122,152	21	84
Kiowa	3,901	38,355	1,190	1,190
Kit Carson	2,981	26,007	4,483	4,483
Lake	1,281	24,690	....	....
La Plata	9,252	78,370	186	770
Larimer	44,611	317,825	7,503	7,570
Las Animas	38,092	271,285	5,443	5,722
Lincoln	10,574	105,756	80,700	80,700
Logan	17,107	122,295	15,122	15,770
Mesa	31,441	144,106	8,850	10,199
Montezuma	7,308	63,600	22	25
Morgan	10,424	73,342	32,708	32,908
Otero	20,771	179,467	5,186	5,295
Ouray	3,177	23,176	1,600	1,200
Park	18,222	127,919	18,528	18,528
Phillips	2,981	19,351	3,720	2,822
Pitkin	2,294	24,880	....	....
Powers	11,591	94,859	8,454	11,497
Pueblo	14,489	131,370	7,712	12,105
Rio Blanco	33,780	333,787	4,273	8,240
Rio Grande	8,946	82,377	8,240	8,240
Routt	40,568	458,771	10,993	22,966
Saguache	23,509	180,840	14,856	15,[illegible]10
San Juan	45	675	....	....
San Miguel	13,836	111,180	....	....
Sedgwick	3,342	18,005	....	....
Summit	1,324	16,990	5,037	2,517
Washington	4,380	21,800	11,590	8,300
Weld	28,434	230,260	42,570	48,070
Yuma	6,096	40,120	1,235	1,415

The wool clip of Colorado, amounting to 5,800,000 pounds per annum, is known in the trade by the following technical terms, viz., 25 per cent is "carpet wool," "medium fine," and the balance "heavy fine," with a very little "light fine." One-half of the wool clip of the State passes through Denver, but the entire clip is sent East unscoured, at an average freight of $1.50 per 100 pounds. The coarse wools go largely to Philadelphia, and the finer grades to Massachusetts, Connecticut, and other New England points, a distance of 2,000 miles.

Most respectfully submitted.

A. R. KENNEDY,
Stock correspondent.

BUENA VISTA, COLO., *March 5, 1892.*

"BOTTOM DISEASE" AMONG HORSES OF SOUTH DAKOTA.

Early in September, 1892, Dr. E. C. Schroeder, an inspector of the Bureau of Animal Industry, was directed to proceed to Vermillion, S. Dak., and to such other points in that State as might be found necessary, to investigate and determine the character of a disease prevailing among horses. In his report submitted upon his return he gives the following as the result of his investigations:

I reached the locality September 12, and found what is there known as the "Bottom Disease," an affection which takes its name from the fact that it was first observed on the bottom lands along the Missouri River, and believed to be exclusively confined to them. It has existed, as far as could be learned, in the southeastern portion of South Dakota, the northeastern portion of Nebraska, and the western portion of Iowa, where these States are bounded by the Missouri River, for a series of years extending back as far as the memories of the oldest settlers, and lately it has also been noticed on the uplands in addition to its occurrence on the bottom.

In South Dakota the so-called "bottom" is a strip of flat land bounded on one side by the Missouri and on the other by an abrupt bluff. It is several miles wide and very productive, and is supposed formerly to have been the bed of the river; and the bluff, from which the higher land extends northward, sloping gradually upward, is supposed to have been the original bank.

The affection occurs in all horses from 2 years old upwards, in horses running in pasture, and less frequently among work horses. Mules, I am told, have never suffered, and are for this reason used by many farmers. Other animals, cattle, etc., are also immune. Usually the losses are not very considerable, a few deaths every year, but during some years, like the present, they reach truly alarming numbers. This year not less than 1,800 horses have died over a territory only thinly settled from 75 to 80 miles long and from 8 to 10 miles wide. The larger proportion of deaths occur in the latter part of summer and in early fall, and the losses are greatest when an uncommonly wet spring is followed by an unusually warm summer.

The general history of a case of "bottom disease" is a gradual running down in condition. A horse is observed to lack brightness, becomes easily fatigued, has a wornout, tired appearance, does not eat properly, suffers alternately from attacks of constipation and diarrhea, and loses flesh. These symptoms are noticed in spring and gradually increase in degree. The animal becomes restless, stamps with its hind feet, walks about, taking long, swinging strides, and has a peculiar swaying motion about its hind quarters. The head is allowed to hang in a listless manner, a tendency is shown to press it against or rest it upon the manger or anything else that comes in the way, and the eyes have a blank, empty look. About the mouth and face are a number of small abrasions and scars, probably due to rubbing these parts against surrounding objects. The feces are passed in the form of small, hard balls, and the urine is stained a deep dirty yellow. The visible mucous membranes have a decided yellow hue; those of the eye are œdematous and occasionally show small patches of extravasation under the mucosa. The appetite is completely gone; grain, oats, bran, etc., are generally refused altogether, while hay, as a rule, the only food the horse will touch, is eaten sparingly. The emaciation becomes extreme; the outline of every rib is visible through the skin, and the extent to which the muscles of the hips have fallen away gives them more the appearance of the hind quarters of a milch cow than those of a horse. The pulse becomes weak and irregular, and the temperature, which was normal at first, as taken per rectum, is abnormally low, varying from 96⅜° to 100°. The surface temperature is uneven, the extremities, back, and hind quarters are quite cool, the fore quarters, sides of chest, and the abdomen are comparatively warm. The hind quarters in some cases are particularly cold.

The stage following this I had no opportunity to see, but Dr. McCapes, the local veterinarian, told me there was an elevation of temperature, the thermometer registers from 102° to 104°, and death follows in two to three days during severe nervous excitement, or, as many farmers express it, the horse dies perfectly crazy.

All cases do not run the same course; in some instances no particular symptoms are observed until a few days before death, and cases of only two or three weeks' duration are quite common. In all the latter, however, whether they die after a few days or a few weeks, a more or less perfect record can be traced of temporary periods of indisposition during the spring and summer preceding the final affection, and in many cases the nature of these temporary attacks gives the impression that they are the result of a continuous affection of which the symptoms become visible only at irregular periods. Some cases are also reported in which the head and eyes are considerably swollen, but I saw no well-defined example of this.

Five animals were examined post-mortem. The lesions in all were very similar. The autopsy notes are given as follows:

No. 1. Examined September 12, 1892.—Gray gelding, 8 years old; condition very poor; had been dead about twenty-four hours. A considerable amount of blood-stained foam about the nostrils; head somewhat swollen and showing a number of scars about the eyes and face generally.

On reflecting the skin numerous patches of blood extravasation into the subcutaneous tissues are seen, varying from one-quarter inch to 6 inches in diameter, usually surrounded by a mass of gelatinous œdema stained a bright yellow color. These patches are present over the abdomen and chest, and smaller patches of simple extravasation are seen in the connective tissue under the skin of the legs.

A large amount of fluid of a dirty yellow color is found upon opening the abdominal cavity. The great omentum is positively hæmorrhagic, the mesentery congested and stained a saffron color in patches. The serosa of the abdominal wall and intestines show areas of congestion and extravasation and patches of yellow staining. Over the large intestine and portions of the small are scattered a large number of threads composed of a white elastic tissue; they are firmly adherent to the serosa of the intestines, and usually four or five unite to form a little network which terminates in a free end. These threads are about as thick as a piece of fine darning cord, and vary from one-half to 1½ inches in length. The diaphragm is especially thickly covered with them, and they also appear in considerable numbers upon the surface of the liver which rests against the diaphragm.

The lymphatics, the inguinal, mesenteric, and mediastinal glands, and whenever the lymphatics are observed, are surrounded by a yellow gelatinous œdema, and the adjacent tissues, especially in the inguinal region, are stained a bright yellow. The glands themselves are œdematous and have a pale, dull, reddish-yellow appearance on section; they are little if at all enlarged, excepting a gland here and there which is considerably increased in size.

Stomach.—Greatly distended, with abnormally dry, sour-smelling food, so much so as to make it appear larger than normal. The contents are evidently composed entirely of hay, and where they rest against the mucosa they are covered with what seems to be a dirty grayish-white plastic exudate. The mucosa shows several patches of brownish-yellow gelatinous exudate, and is covered with a considerable quantity of the same grayish substance which is found adhering to the food.

Small intestine.—Patches of pigmentation in the form of fine points, congestion in patches formed of such points and fine interlacing lines. An occasional small patch of extravasation under the mucosa.

Large intestine.—Contents of the cæcum and colon in the form of a dirty, turbid fluid. Mucosa shows considerable reddening and a few small patches of extravasation.

Rectum.—Contains small, hard balls of feces, and is more or less congested.

Liver.—Enlarged and quite firm and brittle. The entire organ has a mottled yellowish white and red appearance. On surface and section it seems composed of irregular, small, yellowish-white areas about one-sixteenth inch in diameter, surrounded by thin lines of irregularly blood-stained white. The general impression given by the appearance is such that if the blood-stained lines were removed the organ would look like a large lump of blood and bile-stained fat. Every portion of the liver is involved in this change. The capsule shows patches of thickening, and the surface resting against the diaphragm is covered with the little white threads already spoken of over an area 8 inches in diameter.

Spleen.—Somewhat enlarged, congested, and softened. The surface, and particularly the edges, are marked by numerous minute blood-red elevations under the capsule.

Kidney.—Imbedded in a small amount of fat, which is stained a saffron color. It is somewhat enlarged and pale. On section the papillary portion is slightly reddened and the pale cortex is dotted with innumerable minute blood-red points. The pelvis contains a quantity of yellowish, creamy paste, and shows two or three small patches of extravasations under the mucosa.

Bladder.—Distended with dark yellow, turbid urine.

On opening the thoracic cavity a large amount of yellowish-red liquid is found, a gallon or more.

Lungs.—Œdematous throughout, and showing more or less emphysema in small areas. Patches of extravasation are observed under both the costal and pulmonary pleura varying from one-fourth inch to 3 or 4 inches in diameter. No adhesions or areas of hepatization.

Heart.—The pericardium has an œdematous appearance, is deeply congested throughout, and distended by a large amount of pale yellowish-red fluid.

The heart muscle is very pale; a number of small patches of ecchymotic spots are found both under the epicardium and endocardium. The left ventricle is contracted and empty; the right contains a small yellowish-white clot which has branches of a similar nature extending into the blood vessels. The fat surrounding the base of the heart is œdematous and of a dull, yellow color.

Brain.—From such an examination as it was possible to make of this organ it appeared wholly unaffected.

The blood coagulated slowly and imperfectly, was very dark in color, and flowed in considerable quantities wherever blood vessels were cut.

Another horse was examined on September 14, a brown gelding 10 years old. The lesions in this case were practically similar to those found in the first case, excepting that the amount of fluid in the abdominal and thoracic cavities was comparatively insignificant in quantity. The hæmorrhagic condition of the omentum was absent, patches of extravasation less frequent and smaller, and the liver, while otherwise like that described in the first case, was much redder in appearance, looking as though the liver seen in the first case had become engorged with blood.

From this case two cultures were made in agar, one from the liver and one from the spleen. Both remained sterile.

Cover-glass preparations were made from the liver, spleen, and blood, and forwarded to Dr. Smith, and portions of the liver and spleen were preserved in Müller's fluid and alcohol for microscopic examination.

Following this, three other cases were examined, and the lesions were practically similar to those already described. The last animal examined, a mare between 4 and 5 years old, was killed especially for post-mortem. She had been suffering for a long time and was expected to die almost any moment. In her case the affection of the liver was less extensive than in the other cases; there was less extravasation and very little fluid in the peritoneal and pleural cavities. In the uterus was found a fetus, about 9 inches long from the tip of the nose to the root of the tail, in a state of perfect preservation, excepting that its entire body was stained a yellow color. This staining was most intense in the umbilical region, and became gradually less marked in passing from this point to other portions of the body.

From this mare cultures were made in agar from the blood, liver, spleen, and kidney. All remained sterile. Cover-glass preparations were made from the same organs, and pieces of the liver, spleen, and kidney preserved in Müller's fluid and alcohol for microscopic examination.

In all these horses the ordinary intestinal worms were found in considerable numbers, and in addition to these specimens of the Filaria equina were found floating free in the abdominal cavity of two cases.

The cause of the trouble remains in the dark. In the locality it is generally attributed to a weed known as the "Rattlebox" or "Rattlesnake weed," a plant of the leguminous order, which I believe bears the name "*Crotalaria sagittalis.*" This idea is the result, I think, of some investigations made by a veterinarian in Iowa sometime back, whose paper on the subject I was unable to obtain.

A quantity of the weed was forwarded to the Bureau in Washington. Its exact distribution could not be determined, but it is very probable that it is much more common than the affection, and exists also in localities where "bottom disease" was never heard of.

The water supplied the horses and stock generally is from artesian wells. It flows in continuous streams from the mouths of iron pipes into the troughs from which the animals drink, and the overflow, where the grade is not sufficient to carry it off, is very rapidly absorbed by the dry, light, sandy soil. This water contains a considerable amount of iron and other salts, and is the same where the disease occurs and where it has not been observed. The hay and grain used in feeding the stock are pure and wholesome, and free from ergot, smut, etc. The hay is probably a little coarse, particularly on the bottom lands where the greater number of deaths occur, and this is fed in large quantities, in many instances to the exclusion of other substances. Hence, it is not impossible that the affection is due to the long-continued feeding of a substance great in volume and small in nutritive value.

Viewing the disease as a whole, and comparing it with other known affections, it appears almost identical with the "*Schweinsberger Krankheit*" described in the German books. The description given of the latter in the "*Lehrbuch der speciellen Pathologie und Therapie*," by W. Diecherhoff, Vol. 1, 1892, answers equally well for the bottom disease.

Treatment of the affection, as far as it has been attempted, is merely a history of failures. Even when an animal gives every indication of having made a good recovery, a return of the symptoms with a termination in death is to be looked for and expected.

REPORTS FROM INSPECTORS AND CORRESPONDENTS.

ABORTION OF MARES AND FATALITY AMONG FOALS.

In April, 1892, J. H. Records, V. M. D., of Nashville, Tenn., called the attention of the Chief of the Bureau to the prevalence of a very fatal disease among young foals in that locality, and of an affection which frequently causes brood mares to abort. Dr. Records seems to have had a number of cases, some of which he describes as follows:

The disease I speak of is one affecting the pregnant mares, in a number of instances causing them to abort, or, if the fetus is delivered alive, causing its death in a few hours or a few days at the longest period, generally dying in from twelve to twenty-four hours after birth. Before describing the symptoms presented by the foals I will describe several cases that I attended:

Case I.—B. M. Anderson, by Reine. Her first foal was due April 1, came March 30; dead. She had the run of a paddock and was fed barley morning and evening.

Case II.—Edith May, thoroughbred, produced foals at her 4 and 5 year old form. She was due March 20, and delivered a dead foal April 3. She had run of paddock and was fed on barley.

Case III.—Mooney, by Robt. McGregor, 5 years old. Her first foal; due March 18, foaled April 1, 9 p. m.; foal died 11 p. m. April 2. She had run of paddock and was fed on barley.

Case IV.—Mary Dake, by Enfield; 14 years old; had produced foals at 7, 8, 10, and 11 years, missing the 9th and 12th years, foaling this year a bay colt by Bow Bells; due April 1, foaled April 2, 4 o'clock a. m.; foal dead at 10 a. m. She had exercise of paddock and was fed on barley.

Case V.—Ada H., by Revolver. Has had six colts; missed one year (1890). Due March 7; foaled ch. c. March 12, 12 m.; foal died at 12 m. next day. She had hay and paddock exercise. No barley. I could cite you several other cases, but owing to the existing similarity it is unnecessary, as it is so striking in both the foal and the dam, *i. e.*, the perfect health of the mare previous to, at the time of, and after the period of parturition. Not the slightest pyrexia, anorexia, or lassitude. Nearly all of them in good condition, some plethoric, others in good shape, and a few anæmic. They also present a wide difference in age, breeding, and temperament. Nervous, sanguine, and lymphatic—well bred, finely bred, and scrub stock. There have been no previous abortions. Several of them have had influenza in a mild form during the latter part of the winter.

The diet of some consisted of grass and barley (the barley I examined and found clean and bright); others had nothing but grass through the winter, with a little hay. As to exercise, all of them had the privilege of paddock or pasture.

The water supply a few obtained from wet-weather springs, while the majority drank water which was pumped from a large underground spring to a reservoir and thence piped to them the distance of a mile. I might also add here that this spring supplied the adjoining stock farm through the same pipe, and on this farm the disease does not exist, though only one-half mile distant from the adjoining farm which is infected.

The soil is that of the limestone region upon which the city of Nashville is built. Some of the soil grazed over by the mares is still in its virginity, while the greater portion of it has been broken up and cultivated. The drainage is of the best, and there has been no change in the food and water supply, though the climate, through the winter, and so far this spring, has been unusually changeable and rigorous; much more so than for the last ten years.

I will now describe the symptoms and post-mortem appearances presented by the diseased foals, several of which I have carefully watched from the moment of delivery until death.

First.—All the mares seem to have less trouble in foaling than usual, and right here is presented another peculiar feature—they seem indifferent to their offspring, making little disturbance when it is removed from their presence or dies. Even mares that were notably excited at previous foalings worry but little when the foal is removed. The feta delivered dead are fully matured, some of them having gone over the usual period of gestation a number of days, and show no signs whatever of malformations of any kind.

Those that are born to live six or eight hours only present symptoms of weakness, making repeated attempts to rise without accomplishing the feat, though at the same time they would feed greedily from a bottle if presented to them. Some of them evacuated naturally; others were given enemas of warm water, which accomplished the purpose desired. The urine was in all cases passed without difficulty or assistance.

Now, in an hour from birth, in the foals that only lived six or eight hours, the symptoms, the similarity, and the character which they all presented, began to appear. The first and most characteristic showed in the head, which would gradually drop until the nose touched the ground; then the eyelids would close, and the head, at irregular intervals, would oscillate from side to side, though if startled or touched the head would be raised a few inches, but for a moment only, when the nose would again touch the ground, acting as a support and pivot for the head. This semicomatose condition continues until, through weakness and failure of power, the cervical muscles relax completely, allowing the head to fall on its side, although the foal might be in the sternal position. Following the fall of the head would come on a complete relaxation of the body muscles, and the now perfectly limp body rolls on its side, while the semicomatose condition gradually deepens into a state of coma, never broken, and after a few short gasping breaths the foal dies of asphyxia. This is the principal symptom, but in connection with it is noticed a gradual dilatation of the pupils, progressive and continuing until death.

I have taken the temperature of several cases from the time of delivery until death. The first reading is 100° F., and gradually sinking until the end, when in one case the reading was 93° F., and in no instance above 95° F. The respiration, which at first was normal, soon grows irregular, then intermittent, and is finally brought to a close by a few short gasps, the heart still continuing to beat spasmodically for a few seconds after all respiratory movement has ceased. The heart throughout the disease is strong and much slower than normal, beating regularly until a few minutes before death. There is, in connection with these phenomena, a general atony of the muscular fibers of the intestinal tract, with inability to rid the large and small colon of their retained fecal matter. There is also a partial relaxation of the sphincter ani. The colts that survive twenty-four hours or longer are born apparently healthy and full of life. After removal of the membranes they get up without trouble, amble around the stall, nurse the dam at intervals, and show no signs of the disease; but in ten or twelve hours the semicomatose condition appears, the cervical muscles relax, and the head drops, soon followed by the body; stretched out in the recumbent position they present the same train of symptoms I have described to you in the foals that only lived six or eight hours.

I have held autopsies on five of them and the post-mortem changes present in one are practically the same in them all. All the viscera, lungs, heart, stomach, intestines, spleen, liver, kidneys, and bladder show no pathological change. On opening the spinal canal I find more than an ordinary amount of serum in the subarachoid space, slight congestion of the pia mater with dura mater normal, the blood vessels of the cord, cerebrum, and cerebellum showing a passive hyperæmia, as do also those of the medulla.

On my first visit to the farm, having heard nothing of the number of deaths resulting from the disease in this locality, I naturally concluded that the comatose condition was due to the absorption of the poisonous gases from the retained fecal matter by the blood, thus producing the evident brain depression, so my treatment consisted in enemata of warm water, and they, producing no effect, I injected eserine and pilocarpin hyp. $\frac{1}{30}$ grain each, with no result. This was repeated until $\frac{1}{10}$ grain each had been administered, followed only by profuse salivation, but no evacuations. Whisky and hand-rubbing were also administered without effect, the foals dying in the same length of time as those to which no treatment was given.

One foal, to test the milk, was not allowed to suckle the dam, but was fed on fresh cow's milk previously boiled, without results, while the milk of the mare was fed to a young lamb, producing no effect.

CONDITION OF CATTLE IN THE SOUTHWEST.

Inspector Albert Dean, writing from Kansas City, Mo., under date of March 19, 1892, speaks as follows of the condition of cattle in the Southwest, previous to the opening of the spring traffic:

The condition of the cattle in that part (the Panhandle) of Texas, north and west of the Department quarantine line of 1891, is above the average. The loss from the winter will only be nominal in most cases, and will not exceed 5 per cent on any ranch. This condition is attributed to the abundant supply of rain last season, and the quarantine regulations preventing the ranges from being overstocked with Southern cattle. In a tract of country comprising a dozen or more counties, of which Shackelford would be about the center, a severe drought prevailed during the last summer, and the cattle in that section were extremely poor at the beginning of the winter, and it is now believed that the loss in that section will be fully 50 per cent. South of this, extending west to the Pecos River and south to the Rio Grande and Gulf, the cattle are extremely thin in flesh, and the loss from the winter is variously estimated at from 20 to 30 per cent. West of Midland and the Pecos River the cattle are in better flesh and the loss nominal.

The condition of the cattle in southern Texas will retard somewhat the movements to the Indian Territory, where contracts have been made for grazing over 200,000 head with some ranges yet not rented, which, if cattle can be procured, may increase the number to 300,000 head. The greater portion of these cattle will go to the Creek, Osage, and the small reservations west of the Arkansas River. A fair share, I think, is destined for the Cherokee Outlet, if they do not meet with resistance from the authorities of the Department of the Interior. By reason of the limit (March 1) put on the time when Southern cattle may enter the Cherokee Reservation proper, not over 10,000 have been located there for the season.

The movement of cattle from Texas to the Northwest States and Territories (the larger part from west of the quarantine line, revised regulations) will be fully 50 per cent more than last year, and, if an equitable railroad rate is made, this number would be increased to 100 per cent.

TAPEWORMS AMONG SHEEP IN SOUTH DAKOTA.

Dr. D. A. Cormack writes as follows from Watertown, S. Dak., under date of October 7, 1891:

A few days ago I was called to Clark County, S. Dak., for the purpose of examining a flock of sheep that had been condemned to be destroyed by the State board of health. I picked out the worst looking animal I could find, killed it and made a post-mortem examination. I found ten tapeworms (*Tænia fimbriata*) in the duodenum and several in the gall ducts. The large bowel was covered with granular enlargements, from the size of a pinhead to that of a large pea. The lungs, liver, spleen, and kidneys were soft and flabby. This animal was very much emaciated and thin in flesh before it was killed. The carcass was buried.

The second animal selected for examination was one of the best looking in the flock, a ewe about 2 years of age. In this subject I found six of the tapeworms referred to in the duodenum and one 8 inches long in the gall bladder. Otherwise the internal organs were in a normal condition and the flesh was so healthy looking that I told the family on the farm to use the carcass for food.

I believe that I found the same parasite in wild plovers over two years ago.

I have also seen it in individual sheep from other flocks. I found them in sheep slaughtered by local butchers, and I have no doubt but that our State board of health will reconsider their decision to destroy the flock above referred to. As suggested in the volume issued by your Department ("Parasites of Sheep"), I believe that we have this trouble more or less in all our flocks. It is only within the last year that the farmers of South Dakota have rushed into sheep-farming. The great majority of our farmers have not proper shelter for their flocks during the winter months, consequently it must be expected that there will be considerable loss in some quarters through this disease, aggravated by poor shelter and feeding.

ANGORA GOATS.

During the past few months the Department has been favored with several communications from residents of the Pacific slope on the subject of the Angora goat and the mohair industry. Messrs. Woodward

Bros., of Manton, Tehama County, Cal., state that they own 15 goats, and Mr. Alexander Chalmers, Ingles, Washington County, Oregon, at the time of writing, owned 52 head of these animals. Mr. J. B. Lembert, Yosemite Valley, Mariposa County, Cal., was, until recently, the owner of 156 head of Angoras, said to be thoroughbred. His flock, while away from shelter, was overtaken by a snowstorm, which continued for twenty-six days, and a large number of his animals had to be abandoned to starvation after fifty-seven days of continuous privation.

The following memorial has been prepared and presented to the Fifty-second Congress by the Angora Goat Breeders' Association of California:

To the Senate and House of Representatives of the United States in general assembly convened:

On the 17th day of September, 1885, a number of breeders organized the Angora Goat Breeders' Association of California. Subsequently a constitution was adopted and breeders from any and every State or Territory were declared eligible to membership. The object of the association was, and now is, to advance the mohair industry, and at their annual meetings to report their advancements in breeding, handling, and general management of their flocks.

Annual meetings were held at regular times, the seventh or last being held at Sacramento, Cal., on the 17th day of September, 1891. It was adopted that this association prepare and present a memorial to Congress and United States Senate, setting forth the condition of the Angora goat industry in the United States, and petition for aid to make further advancements possible.

In Arizona, California, Colorado, Georgia, Idaho, Kentucky, Montana, Nevada, New Mexico, Oregon, Tennessee, Texas, Virginia, and Wyoming the industry is now well established and carried on profitably. In Alabama, Arkansas, Connecticut, Dakota, Florida, Illinois, Iowa, Kansas, Missouri, New Jersey, New York, North and South Carolina, Ohio, Washington, West Virginia, Pennsylvania, and Wisconsin experiments are being made, some reported successful. While there are no restrictions laid on the exportation of live stock from any other country to the United States, under general laws permitting private individuals such privileges unmolested, the Turkish Government strictly prohibited the exportation of goats more than ten years ago, and new strains of blood can not be obtained by private enterprise from that source.

Mohair, the fleece product of the goat, is apparently on a standstill instead of an advancement; the uniform fine, silky, and lustrous staple, suitable for most fashionable dress goods for ladies' and gentlemen's wear, commands a fair, remunerative price in the markets of the country, and is the smallest portion of the clip.

The product of the inferior low-grade goat commands uncertain values and is the larger portion of the product.

First-class, or best blooded animals, now obtainable from so-called pure-blood breeders, are generally sold at high prices, transportation adding greatly to their cost, and the result of cross breeding is frequently discouraging to the breeder's hopes to improve his stock.

Admitting that this pure-blood stock is of early importation by their owners, the present system of breeding in for ten years or longer, by many breeders, is unavoidable, but damaging to the constitutional powers of sires for reproduction, therefore grade stock of good constitution improves but little, and, the product of fleece not improving, discourages the small breeder of grade stock.

The aid now asked for and the benefits sought to be received through the liberal action of the Government is not for the present alone, nor for the benefits of a few, but for the good of all the breeders of Angora goats in the different sections of our country, and for the extension and improvement of an industry of great value both to the citizens and Government of the United States.

A vast domain now lying idle and unoccupied, being not suitable for any other domestic animal, can be made productive by fostering this live-stock industry.

Compliance with the reasonable request will be gratefully recognized and bear good results, while refusal will delay the further development of this most valuable industry.

Now, the association prays that the National Legislature may recognize the importance of this subject, will pass laws and provide for the establishment of a Government breeding farm of pure blooded Angora goats.

First. Authorizing the honored Secretaries of State and Agriculture to negotiate with the Turkish Government for the sale of, and permit to purchase and remove from Asia Minor, a flock of Angora goats. No less than 100 does (twice that number more preferable) and no less than 25 bucks.

Second. To authorize the Secretary of Agriculture to engage suitable persons to proceed to Turkey, examine goats of different localities, to select the very best to be found, and purchase those animals by them selected, and to remove to seaport and ship on the safest and very best route to the United States, giving them personal attention and care on the way, and upon the arrival in the United States deliver the same to the duly appointed agents of our Government here, with full reports of the examination of climatic resources of Angora and other matters of general interest to the breeders.

Third. To authorize the Secretary of Agriculture to select a suitable locality for keeping the said Angora stock, appoint qualified persons to take care of them, keep them separate from any private property of this kind, and to provide well for their increase, keeping a register of the breeding and cross breeding of said stock, together with date of birth of the kids and their numbers for identification.

Fourth. To authorize from the increase of this flock, not diminishing the original number, to distribute to breeders in the different States at uniform rates, never exceeding one male and one female to one breeder.

Now, can there be a more reasonable prayer presented, appealing to the National Legislature for recognition of the importance of this subject and providing for aid to this industry?

Therefore, for the granting of their request the petitioners, the Angora goat breeders of the United States will ever pray, etc.

By order of the A. G. B. A.

JULIUS WEYAND,
Secretary.

DISEASE AMONG KOREAN CATTLE.

Dr. H. N. Allen, secretary of the United States Korean legation, in a dispatch to the Secretary of State, gives the following account of a very fatal disease which annually prevails among cattle in Korea:

LEGATION OF THE UNITED STATES,
Seoul, Korea, October 20, 1891.

Korea is well supplied with an excellent breed of cattle. The animals are of great size, well formed, and usually of light tan color. The use of milk seems to be unknown, as no cows are kept for this purpose except by the foreigners, who pronounce them to be good milkers. The cows are used mostly by the farmers for plowing, etc., or are confined to certain sections. The bulls not castrated are used principally as beasts of burden and occupy the roads. They are either harnessed, tandem, to a heavy cart with the yoke connecting the ends of the shafts resting on the neck of one, or fitted with pack frames. By this means they bear heavy loads. These bulls are seldom vicious. They are kept so constantly at hard work, and mingle so freely with the crowds of men, ponies, chairs, etc., in the roads and on the ferries that, in the absence of cows, they are quiet enough.

Considerable meat is used in the food of the people, and, in addition to the worn-out bulls that are sold to the butcher, good, fat, young animals are regularly killed. The butcher's trade is a recognized and lucrative calling. As native taste is opposed to the removal of more blood from the meat than is necessary, the animal is not bled, death being caused by strangulation by means of a pointed pole forced into the air passages.

Several foreign capitalists, attracted by the magnificence of the cattle, the excellent climate and cheap lands, have conceived the idea at various times of establishing a cattle ranch and dairy farm here for the purpose of supplying the markets of the Chinese and Japanese ports with fresh beef and dairy products, but on investigation the scheme has been deemed impracticable because of an endemic, and at times epidemic disease which is very destructive to the cattle, and which would work great havoc in a confined herd.

Every summer this disease prevails to a certain extent throughout the peninsula, and nearly every year it is epidemic in some province or section. The past season has witnessed an unusually severe visitation in the neighborhood of this capital. Transportation is so delayed in consequence that it costs $3 per ton to get coal from the river into the city—a distance of from 2 to 3 English miles. The people are using human labor in plowing for their winter wheat. It is not an uncommon sight at present to see four men hitched to a plow doing the work of a bull. Many fields will not be plowed. The crops raised on those plowed in this feeble way must be light, and, as the individual surplus is seldom great, considerable distress must result, as the man who has heretofore made his living as a freighter will be at a loss to support his family during the winter without the aid of his bull.

At present, for some 50 miles (English) out from this city, the roads are lined with the carcasses of the cattle that have died on the way; for the owners, in their improvident manner, usually continue to urge them on even after they have shown signs of sickness, and only cease when the faithful beast falls down unconscious. The meat is not used, as a rule, it being considered dangerous to man, though I can learn of no authentic case where death has resulted from using the meat, and no small portion is used in certain localities by the very poor, while along the roads crowds of howling dogs may be seen devouring the half buried remains of beasts that have so died. The hides are saved, as the bones will be later on, these articles being among the regular exports of the country.

The disease, sometimes called cow cholera by the people, seems to be an enteric fever with severe intestinal catarrh, resulting in an inflammatory degeneration of the liver, and is possibly brought about through the use of filthy water containing excrementitious and decomposing vegetable matter.

The onset of the disease is a severe diarrhea, during which the beast is kept at its laborious work in the excessive heat, and if the discharges are contagious the road side brooks soon become generally infected, and all the animals in the district are liable to become affected in consequence.

Ordinarily the disease runs on for four or five days till the bull's ears droop, his sight fails, and he staggers and falls on the roadside; arising when relieved of his burden he eagely takes water, but usually dies soon after having reached this stage.

On examination, post-mortem, the lungs are found to be spongy and discolored, due no doubt to the smoking the animal has been subjected to before death. The abdomen is enormously distended with gas, and the coats of the stomach and intestines are very dry. The liver seems to be the chief seat of trouble, being infiltrated with pus, easily broken down and more or less enlarged; the gall bladder, owing to the stoppage of the duct, being enlarged to near the size of a man's head, but containing no calculi. I am unable to say if the rupture of this sac is the cause of the many cases of sudden death; it may be so. The great change in the liver, and especially the enlargement of the gall bladder, is observed by and well known to the natives, who believe that if they could have a medicine that would remove this bile the beast would get well.

The only remedy of any value, apparantly, is a change to mountain air. A prominent owner will at once drive his animals high up the mountain side on the first appearance of the disease. The pure water doubtless has more to do with the cure commonly resulting from this course than anything else. Generally, however, the customary carelessness permits the animal to go on to the last stages before anything is done for its relief, the chief resort at this stage being the burning of damp straw under the beast's nostrils as it gasps for breath, a remedy so disagreeble that even a dying bull resents it, and shows some signs of life in its attempts to move from the offensive smudge.

H. N. ALLEN, M. D.,
Secretary of Legation.

LAWS OF THE STATES AND TERRITORIES FOR THE CONTROL OF CONTAGIOUS ANIMAL DISEASES.

Laws of the States and Territories for the control of contagious and communicable diseases of domestic animals not heretofore published in the annual reports of this Bureau will be found below:

DELAWARE.

AN ACT to prevent the spread of contagious or infectious pleuro-pneumonia among the cattle of this State.

Be it enacted by the senate and house of representatives of the State of Delaware in general assembly met, That whenever the governor of this State shall receive reliable information that the disease known as contagious or infectious pleuro-pneumonia exists among any cattle in this State, he shall have power, and is hereby authorized, to issue his proclamation, stating that the said infectious or contagious disease exists in this State, and warning all persons to seclude all animals in their possession that are affected with such disease, or have been exposed to the infection or contagion thereof, and ordering all persons to take such precautions against the spreading of such disease as the nature thereof may, in his judgment, render necessary or expedient; to order that any premises, farm or farms, where such disease exists or has existed, to be put in quarantine so that no domestic animal be removed from such places so quarantined, and to prescribe such regulations as he may judge necessary or expedient to prevent infection or contagion being communicated in any way from the places so quarantined; to call upon sheriffs and deputy sheriffs in this State to carry out and enforce the provisions of such proclamations, orders, and regulations; and it shall be the duty of all the sheriffs and deputy sheriffs to obey and observe all orders and instructions which they may receive from the governor in the premises; to employ such and so many medical and veterinary practitioners, and such other persons as he may, from time to time, deem necessary to assist him in performing his duties as set forth in this act, and to fix their compensation; when in his judgment it shall be deemed necessary to order all or any animals coming into this State to be detained at any place or places for the purpose of inspection and examination; to prescribe regulations for the destruction of animals affected with the said infectious or contagious disease, and for the proper disposition of their hides and carcasses, and of all objects which might convey infection or contagion (provided that no animal shall be destroyed unless first examined by a medical or veterinary practitioner in the employ of the governor as aforesaid); to prescribe regulations for the disinfection of all premises, buildings, and railway cars, and of objects from or by which infection or contagion may take place, or be conveyed; to alter and modify, from time to time, as he may deem expedient, the terms of all such proclamations, orders, and regulations, and to cancel or withdraw the same at any time.

SEC. 2. That in any case where, in the opinion of the governor, it may be deemed necessary to destroy any diseased animal or animals, the said governor shall select and appoint three judicious and impartial citizens of this State to view, and after such view to assess, any such diseased cattle at what would be their real value in money were they not so affected; and in case said cattle shall be destroyed, as provided in the first section of this act, then upon certificate of such assessment, duly signed and attested by said assessors, or a majority of them, being presented by the owner or owners of such destroyed animals to the State treasurer of this State, the said State treasurer is hereby authorized to pay to such owner or owners a sum of money equal to two-thirds of the amount of the aggregate assessment upon said cattle so destroyed.

SEC. 3. If any person shall sell or dispose of any animal or animals known to be affected with pleuro-pneumonia, or known to have been exposed thereto within one year prior to such sale or disposal, without due notice to such purchaser that said disease exists in said animals, or that they have been exposed thereto, as aforesaid, he shall be deemed guilty of a misdemeanor, and shall be punished by fine not exceeding five hundred dollars, or may, in the discretion of the court, be imprisoned for a term not exceeding one year.

SEC. 4. If any one knows, or has reason to suspect, that said disease exists among the cattle in his possession, or under his care, he shall forthwith give notice thereof to the governor, and for failure so to do shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

SEC. 5. Any person disobeying the orders of the governor, sheriff, or deputy sheriff, made in conformity to this act, or any person driving or transporting any neat cattle contrary to the regulations made and published, as aforesaid, shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

SEC. 6. That all the necessary expenses incurred under the direction, or by the authority of the governor, in carrying out the provisions of this act, shall be paid by the State treasurer, upon proper certificate of the assessors of diseased cattle which have been destroyed, or upon warrant duly made and signed by the governor, on the State treasurer, for all expenses incurred under this act other than the payment for cattle destroyed.

SEC. 7. That animals coming from a neighboring State that have passed a veterinary examination in said State, or have been quarantined and discharged, the owner or driver being provided with a genuine certificate that such animals are not infected with pleuro-pneumonia shall not be subject to the provisions of this act.

SEC. 8. That all the provisions of this act applicable to the disease known as pleuro-pneumonia be also, and is hereby extended to and made applicable to all other infectious or contagious cattle diseases which are virulent and fatal in their nature.

Passed at Dover, March 29, 1881.

AN ACT supplementary to an act entitled "An act for the prevention of cruelty to animals," passed at Dover, February 20, 1873.

Be it enacted by the senate and house of representatives of the State of Delaware in general assembly met (two-thirds of each branch thereof concurring therein), If any person shall abandon to die in any public place within this State, any maimed, sick, infirm or disabled animal, such person shall be guilty of a misdemeanor, and it shall be lawful for any justice of the peace to appoint suitable persons to destroy and remove such animal, if such person so appointed shall consider such animal unfit for further use, at the cost of the owner thereof, recoverable before said justice of the peace in an action of debt.

SEC. 2. Any public officer or constable, of any city or county, shall, upon his view of any such misdemeanor, or upon the complaint of any other person who may declare his or her name and abode to such police officer or constable, make arrest and bring before any justice of the peace thereof offenders violating the provisions of this act.

SEC. 3. All the fines, penalties, and forfeitures imposed and collected in any county of the State under the provisions of this and every act passed, or which may be passed, relating to or affecting animals, in every case where the prosecution shall be instituted and conducted by the society incorporated pursuant to the provisions of chapter four hundred and seventy-seven, volume fourteen, Laws of Delaware, being an act entitled "An act to incorporate the Delaware Society for the Prevention of Cruelty to Animals," shall *(ensure) to such society in aid of the purposes for which it was incorporated.

SEC. 4. All acts or parts of acts inconsistent with this act be and the same are hereby repealed.

Passed at Dover, April 8, 1881.

AN ACT to amend chapter three hundred and seventy-nine of volume sixteen of the laws of Delaware.

Be it enacted by the senate and house of representatives of the State of Delaware in general assembly met, That chapter three hundred and seventy-nine, volume sixteen, entitled "An act to prevent the spread of contagious or infectious pleuro-pneumonia among cattle of this State," be and the same is hereby amended as follows, to wit: Strike out of section one, line twenty-two and twenty-three of said act, all after the word "such" in line twenty-two, to the word "other" in line twenty-three, and insert, after the word "compensation" and before the word "when," in line twenty-five of said section, the following, viz: "and to co-operate with the Commissioner of Agriculture of the United States, or any other United States officers who are authorized by the statutes of the United States to use the money of the Federal Government as is necessary in investigating and in such disinfection and quarantine measures as may be necessary to prevent the spread of the disease." Insert, after the word "governor" and before the word "as," in line thirty-four of said section, the words "or the United States Commissioner of Agriculture."

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*So in enrolled bills.

And further amend section two by inserting between the words "affected" and "and" in line six of said section, the words, "*Provided*, That such valuation shall not in any case exceed the sum of fifty dollars per head." Insert in line nine of said section, between the words "them" and "being," the words "and approved by the governor." Insert in line four of section four of said act, between the words "do" and "shall," the words, "shall be deemed guilty of a misdemeanor, and upon conviction thereof." Amend section five, line four, of said section, by inserting between the words "aforesaid" and "shall," the words, "shall be deemed guilty of a misdemeanor, and upon conviction thereof." Amend further by striking out of section six of said act all after the word "upon," in line four of said section, to the word "upon," inclusive, in line five. And further amend the act by adding thereto the following as an additional section:

"SEC. 9. That in the execution of the provisions of section 6 it is hereby provided that there shall not be expended more than the sum of three hundred dollars in any one year."

Passed at Dover, January 22, 1885.

AN ACT to prevent the spread of contagious or infectious pleuro-pnemonia among the cattle of this State.

Be it enacted by the senate and house of representatives of the State of Delaware in general assembly met, That whenever the governor of this State shall receive reliable information that the disease known as contagious or infectious pleuro-pneumonia exists among any cattle in this State, he shall have power, and is hereby authorized, to issue his proclamation, stating that the said infectious or contagious disease exists in this State, and warning all persons to seclude all animals in their possession that are affected with such disease, or have been exposed to the infection or contagion thereof, and ordering all persons to take such precautions against the spreading of such disease as the nature thereof may, in his judgment, render necessary or expedient; to order that any premises, farm or farms, where such disease exists or has existed, to be put in quarantine, so that no domestic animal be removed from such places so quarantined, and to prescribe such regulations as he may judge necessary or expedient to prevent infection or contagion being communicated in any way from the places so quarantined; to call upon all sheriffs and deputy sheriffs in this State to carry out and enforce the provisions of such proclamations, orders, and regulations; and it shall be the duty of all the sheriffs and deputy sheriffs to obey and observe all orders and instructions which they may receive from the governor in the premises; to employ such other persons as he may, from time to time, deem necessary to assist him in performing his duties as set forth in this act, and to fix their compensation; and to coöperate with the Commissioner of Agriculture of the United States, or any other United States officers who are authorized by the statutes of the United States to use the money of the Federal Government as is necessary in investigating and in such disinfection and quarantine measures as may be necessary to prevent the spread of the disease; when in his judgment it shall be deemed necessary to order all or any animals coming into this State to be detained at any place or places for the purpose of inspection and examination; to prescribe regulations for the destruction of animals affected with the said infectious or contagious disease, and for the proper disposition of their hides and carcasses, and of all objects which might convey infection or contagion; (*Provided*, That no animal shall be destroyed unless first examined by a medical or veterinary practitioner in the employ of the governor or the United States Commissioner of Agriculture, as aforesaid); to prescribe regulations for the disinfection of all premises, buildings, and railway cars, and of objects from or by which infection or contagion may take place or be conveyed; to alter and modify, from time to time, as he may deem expedient, the terms of all such proclamations, orders, and regulations, and to cancel or withdraw the same at any time.

SEC. 2. That in any case where, in the opinion of the governor, it may be deemed necessary to destroy any diseased animal or animals, the said governor shall select and appoint three judicious and impartial citizens of this State to view and, after such view, to assess any such diseased cattle at what would be their real value in money were they not so affected: *Provided*, That such valuation shall not in any case exceed the sum of fifty dollars per head. And in case said cattle shall be destroyed, as provided in the first section of this act, then upon certificate of such assessment, duly signed and attested by said assessors, or a majority of them, and approved by the governor, being presented by the owner or owners of such destroyed animals to the State treasurer of this State, the said State treasurer is hereby authorized to pay to such owner or owners a sum of money equal to two-thirds of the amount of the aggregate assessment upon said cattle so destroyed.

SEC. 3. If any person shall sell or dispose of any animal or animals known to be affected with pleuro-pneumonia, or known to have been exposed thereto within one year prior to such sale or disposal, without due notice to such purchaser that said disease exists in said animals, or that they have been exposed thereto as aforesaid, he shall be deemed guilty of a misdemeanor, and shall be punished by fine not exceeding five hundred dollars, or may, in the discretion of the court, be imprisoned for a term not exceeding one year.

SEC. 4. If any one knows or has reason to suspect that said disease exists among the cattle in his possession or under his care, he shall forthwith give notice thereof to the governor, and for failure so to do, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by fine not exceeding five hundred dollars or by imprisonment not exceeding one year.

SEC. 5. Any person disobeying the orders of the governor, sheriff, or deputy sheriff, made in conformity to this act, or any person driving or transporting any neat cattle contrary to the regulations made and published as aforesaid, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by fine not exceeding five hundred dollars or by imprisonment not exceeding one year.

SEC. 6. That all the necessary expenses incurred under the direction or by the authority of the governor, in carrying out the provisions of this act, shall be paid by the State treasurer, upon warrant duly made and signed by the governor on the State treasurer, for all expenses incurred under this act other than the payment for cattle destroyed.

SEC. 7. That animals coming from a neighboring State, that have passed a veterinary examination in said State, or have been quarantined and discharged, the owner or driver being provided with a genuine certificate that such animals are not infected with pleuro-pneumonia, shall not be subject to the provisions of this act.

SEC. 8. That all the provisions of this act applicable to the disease known as pleuro-pneumonia be also and is hereby extended to and made applicable to all other infectious or contagious cattle diseases which are virulent and fatal in their nature.

SEC. 9. That in the execution of the provisions of section 6 it is hereby provided that there shall not be expended more than the sum of three hundred dollars in any one year.

Passed at Dover, March 29, 1881.

Amended January 22, 1885.

AN ACT for the protection of live stock in the State of Delaware.

Be it enacted by the senate and house of representatives of the State of Delaware in general assembly met, That from and after the passage of this act it shall not be lawful for any person or persons to bring or have brought into the State of Delaware any Texas or Cherokee cattle, except said cattle be slaughtered.

SEC. 2. Any person or persons violating the provisions of this act shall be liable to a penalty of twenty (20) dollars and costs for each and every head of said cattle brought into the State.

SEC. 3. One-half of all penalties incurred under this act shall belong to the informer, and be for the use of any one who may sue for the same, in his own name; the other half to be paid to the State treasurer for State purposes, to be recovered the same as any other debt before a justice of the peace. The justice of the peace, constable, or sheriff shall be entitled to the same fees as the law now sets forth.

Passed at Dover, March 20, 1877.

AN ACT to amend chapter 379, volume 15, Laws of Delaware.

Whereas a company has been formed in the city of Wilmington for the purpose of erecting extensive slaughterhouses and purchasing cattle on a large scale; and

Whereas it will be a great advantage not only to the farmers, but the citizens generally, to have a market and industry of this kind in our State; and,

Whereas the supply of cattle from this State would be greatly inadequate to meet the demands of this new market, in consequence of which it will be necessary for a portion of the supply to come from other States, and it appearing that the object of the original act can be accomplished under the restrictions provided in the proposed amended bill:

Be it enacted by the senate and house of representatives of the State of Delaware in general assembly met, That chapter 379, volume 15, Laws of Delaware, entitled "An act for the protection of live stock in the State of Delaware," be and the same is hereby amended by adding thereto the following:

"*Provided,* That it shall be lawful for any person or company to bring or have brought into this State the kinds of cattle prohibited by the first section of the act to which this is an amendment, under and subject to the following restriction: That all such cattle shall be taken directly from the cars on which they are transported to the abattoir, slaughterhouse, or inclosure connected therewith, and kept therein until slaughtered. Any violation of this restriction shall subject the offender or offenders to the same penalty as provided in the second section of the act to which this is an amendment."

Passed at Dover, February 19, 1891.

IDAHO.

AN ACT to suppress and prevent the dissemination of contagious or infectious diseases among domestic animals and to protect stock owners.

Be it enacted by the legislative assembly of Idaho Territory, as follows: The governor of the Territory is hereby authorized to nominate and, by and with the advice and consent of the council, appoint three residents of the Territory, who must be practical stockmen, as members of a board of live stock commissioners, to carry into effect the provisions of this act relating to the suppression of contagious or infectious diseases among domestic animals. Before entering upon the discharge of his duties, each member of such board and every other officer provided by this act, shall take and subscribe an oath to faithfully perform the duties and obligations imposed upon him by the provisions herein contained; which oath shall be filed in the office of the secretary of the Territory.

SEC. 2. The governor is also authorized to nominate and, by and with the consent and advice of the council, appoint a suitable person as Territorial stock inspector, who must be a graduate in good standing of a reputable veterinarian school, and who is by this act placed under the direction of the board of live stock commissioners.

SEC. 3. The board shall select its own chairman and secretary, may make such rules and regulations for the transaction of its business, not inconsistent with the provisions of this act, as they may deem expedient and necessary. A full record of all the proceedings of said commissioners shall be kept by the secretary thereof.

SEC. 4. It is the duty of the board of county commissioners of each county to appoint a suitable resident citizen of the county, who must be a practical stockman, as county stock-inspector, whose duty shall be to report in writing to the chairman of the board of live-stock commissioners any information concerning the existence of contagious or infectious diseases among live stock in his county and also to perform all duties imposed upon him by the territorial board of live-stock commissioners. Each county inspector shall be allowed the sum of five dollars per day for each day's services performed by him under the direction of the board of live-stock commissioners, said compensation to be paid out of the county treasury.

SEC. 5. The duties of said board of live-stock commissioners shall be as follows: To investigate, or cause to be investigated, any and all cases of contagious or infectious disease among domestic animals in this Territory, of which the said board may have knowledge or which may be brought to their notice by the county stock inspector or by any resident in the locality where such disease exists. And it shall also be the duty of the board, in the absence of specific information, to direct the Territorial stock-inspector to make visits of inspection to any locality where they may have reason to suspect that there is contagious or infectious disease. To inspect or cause to be inspected, under the regulations of this act, all domestic animals that may arrive at any railroad station in this Territory, when these animals are such as to warrant the presumption that they are intended to remain in the Territory, and are to be, or, may be, used for breeding purposes therein. And it shall be the duty of the owner, or in his absence, of the person in charge of such animals so arriving, to notify the chairman of the board of live-stock commissioners of their arrival, without delay, and not to allow such animals, or any of them, to leave the place of arrival until he receives a certificate from the board signed by the chairman thereof, authorizing their removal. Should it appear to the satisfaction of the board that these animals so arriving, or any of them, are infected with contagious disease, the said board shall direct the Territorial stock-inspector to inspect said animals, reporting to the board the result of his inspection. And no animal pronounced unsound by the board shall be turned loose, removed, or permitted to escape, but shall be held subject to the order of the board. Any person failing to comply with this provision shall be deemed guilty of a misdemeanor and upon conviction shall be fined not less than fifty nor more than five hundred dollars for each offense.

SEC. 6. In all cases of contagious or infectious diseases among domestic animals in this Territory, the board of live-stock commissioners shall have authority to order the quarantine of the infected premises, and, in case such disease becomes epidemic in any locality in this Territory, the board shall immediately notify the governor of the Territory, who shall thereupon issue his proclamation, forbidding any animal of the kind among which said epidemic exists to be transferred from said locality without a certificate from the board, showing such animal to be healthy.

SEC. 7. In any case of epidemic disease where premises have been previously quarantined by the board, as before provided, they are further authorized and empowered, when in their judgment necessary, to order the slaughter of any or of all diseased animals upon said premises and of all animals that have been exposed to contagion or infection under the following restrictions: Said order shall be a written one and shall be made in duplicate, and there shall be a distinct order and duplicate for each owner of the animals condemned, the original of each order to be filed by the chairman of the board with the governor and the duplicate given to said owner; and, further, before slaughtering any animal or animals that has been exposed only, and does not show disease, the board or officer authorized by the board shall call into consultation two reputable and well-known stock-owners, residents of the Territory, and the officer shall have the written indorsement upon his order of at least one of said consulting stock-owners, stating that such action was necessary, and the consent of the owner or person in charge, before such animal or animals shall be slaughtered.

SEC. 8. Whenever, as herein provided, the board of live-stock commissioners shall order the slaughter of one or more animals, the officer executing the order shall at the time of receiving such order notify, in writing, the nearest justice of the peace, who shall thereupon summon three disinterested citizens (who shall be stock-owners) of the neighborhood to act as appraisers of the value of such animals. Said appraisers, before entering upon the discharge of their duties, shall be sworn to make a true and faithful appraisement without prejudice or favor. They shall, after making their appraisement, return certified copies of their valuation, a separate one being made for each owner, together with an accurate description of each animal slaughtered (giving all brands, earmarks, wattles, age, sex, and class, as to whether American, half-breed, or Texas), to the justice of the peace by whom they were summoned, who shall, after entering the same upon his record and making an indorsement upon each, showing it to have been properly recorded, return it, together with the duplicate order to the board, to the person or persons owning the animals slaughtered, and it shall be the duty of the Territorial stock-inspector or the county stock-inspector, as the board of live-stock commissioners may direct in their order, to superintend the slaughter of such animals as may be condemned, and also the destruction of the carcass, which latter shall be by burning to ashes, and shall include every part of the animal and hide, and also excrement as far as possible. He shall cause the said slaughter and burning to be done as cheaply as possible and shall certify to the board of county commissioners of the county in which such slaughter is done the amount of said expense, which shall be paid out of the county treasury, and he shall also report to the board of live-stock commissioners the result of his labors.

SEC. 9. The county stock-inspectors shall report annually to the board of live-stock commissioners, at the time that the other county officers report to the Territorial officers, a full statement of all matters connected with their work and of all duties performed by them during the year. The board of live-stock commissioners shall make an annual report, on or before the first day of December, to the governor of all matters connected with their work, and the governor shall transmit to the several boards of county commissioners such parts of said report as may be of general interest to the breeders of live stock. The governor shall also give information in writing, as rapidly as he obtains it, to the various boards of county commissioners, of each cause of suspicion or first eruption of disease in each locality, its course, and the measures adopted to check it.

SEC. 10. Whenever the governor of the Territory shall have good reason to believe that any disease covered by this act has become epidemic in certain localities in another State or Territory or that conditions exist which render domestic animals liable to convey disease, he shall thereupon, by proclamation, schedule such localities and prohibit the importation from them of any live stock of the kind diseased into this Territory, except under such restrictions as he may deem proper. Any corporation, or any person or persons, who, after the publication of such proclamation, shall knowingly receive in charge any such animal or animals from any one of said prohibited districts and transport or convey the same within the limits of this Territory shall be deemed guilty of a misdemeanor and upon conviction fined not less than one thousand dollars nor more than ten thousand dollars for each and every offense, and shall further become liable for any and all damages and loss that may be sustained by any person or persons by reason of the importation or transportation of such prohibited animals.

SEC. 11. It shall be the duty of any person or persons who shall have or suspect that there is upon his or their premises any case of contagious or infectious disease among domestic animals, to immediately report the same to the board of live-stock commissioners; and a failure so to do, or any attempt to conceal the existence of such disease or to wilfully or maliciously obstruct or resist the said board or its legally appointed agent in the discharge of his duty as hereinbefore set forth, shall be deemed a misdemeanor. Any person or persons who shall be convicted of any one of the above acts or omissions shall be fined not less than fifty dollars nor more than five hundred dollars for each and every such offense, shall forfeit all claims to indemnity for loss, and upon conviction a second time shall, in addition to the above-named fine, be imprisoned for a term not less than thirty days nor more than six months.

SEC. 12. The following regulations shall be observed in all cases of disease covered by this act: First, it shall be unlawful to sell, give away, or in any manner part with any animal affected with or suspected of contagious or infectious disease, and, in the case of any animal that may be known to have been affected with or exposed to any such disease within six months prior to such disposal, due notice of the fact shall be given in writing to the party receiving the animal. Second, it shall be unlawful to kill for butcher purposes any such animal, to sell, give away, or use any part of it or its milk, or to remove any part of the skin. A failure to observe these provisions shall be deemed a misdemeanor and on conviction shall be punished by a fine not less than one hundred dollars, nor exceeding five hundred dollars. It shall be the duty of the owner or person having in charge any animal affected with or suspected of any contagious or infectious disease to immediately confine the same in a safe place, isolated from other animals, and with all necessary restrictions to prevent dissemination of the disease until action is taken by the board.

The above regulations shall apply as well to animals in transit through the Territory, as to those resident therein, and the Territorial stock-inspector or the county stock-inspector of each county shall have full authority to examine, whether in car, or yards, or stables, all animals passing through the Territory, or any part of it, and, on detection or suspicion of disease, to take possession of, report them to the board, and by their authority to treat and dispose of said animals in the same manner as is prescribed for animals resident in the Territory.

SEC. 13. All claims arising from the slaughter of animals under the provisions of this act shall, together with the order of the board of live-stock commissioners and the valuation of the appraisers in each case, be submitted to the board of county commissioners of the county in which said animals have been slaughtered, who, at their regular meeting next ensuing shall examine them, audit the same, and, for such as they find equitable and entitled to indemnity, shall allow the same to be paid out of the county treasury. In auditing any claim under this act, it shall be the duty of the board of county commissioners to satisfy themselves that it does not come under any class for which indemnity is refused by this act, and they shall require the affidavit of the claimant to this fact, or, if the claimant be not cognizant thereof, then of some reputable person who is cognizant thereof, and also the certificate of the officer under whose direction the animals were slaughtered (whose duty it shall be to inform himself fully of the facts) that in his opinion the claim is legal and just, and the board of commissioners may at their discretion require further proof. The indemnity to be granted shall be two-thirds of the ordinary value of the animal as determined by the appraisers, without reference to its diminished value because of being diseased. It shall be the duty of the owner to make application to the board of county commissioners for payment, presenting the proofs prescribed herein, within six months of the slaughter of the animal for which payment is claimed, failing which such claim shall be barred by limitation. These payments shall be paid by the county treasurers on warrants ordered by the board of county commissioners and from the fund provided by this act. The right to indemnity under this act is limited to animals destroyed by reason of the existence or suspected existence of some epizoötic disease, generally fatal and incurable, such as rinderpest, hoof-and-mouth disease, pleuro-pneumonia, anthrax, or Texas fever among bovines, glanders among horses, and anthrax among sheep. For the ordinary contagious diseases not in their nature fatal, such as scab or hoof-rot in sheep and epizoötic influenzas in horses, no indemnity shall be paid.

The right to indemnity shall not exist, and payment of such shall not be made in the following cases: First, for animals belonging to the United States. Second, for animals that are brought into the Territory contrary to the provisions of this act. Third, for animals that are found to be diseased, or that are destroyed because they have been exposed to disease before or at the time of their arrival in the Territory. Fourth, when any animal was previously affected by any other disease which from its nature and development was incurable and necessarily fatal. Fifth, when the owner or person in charge shall have knowingly or negligently omitted to comply with the provisions of sections eleven and twelve of this act. Sixth, when the owner or claimant, at the time of coming in possession of the animal, knew it to be diseased or received the notice specified in the first clause of section twelve of this act.

SEC. 14. The board of live-stock commissioners shall hold four meetings each year on the second Monday in January, April, July, and October, said meetings not to be more than three days in duration, for which each member shall be allowed the sum of five dollars per day, to be paid out of the Territorial treasury. Each member shall be allowed a salary of fifty dollars per year. The chairman of said board is hereby authorized to call special meetings of said board whenever he deems it necessary, but for which no per diem shall be allowed. The Territorial stock inspector shall receive for his services the sum of fifteen hundred dollars per annum. He shall hold his office for two years. The appraisers herein provided for shall receive three dollars per day for each day or part of day they may be actually employed as such, which claim shall be filed with the board of county commissioners for the county, together with a certificate of the justice who summoned them. The justice shall receive his ordinary fee for issuing a summons.

SEC. 15. The board of county commissioners is hereby authorized to levy, at the time of making the annual assessment, a special tax not exceeding one mill on the dollar, upon the assessed value of all cattle, sheep, horses and mules in the county, to be known as the county stock indemnity fund, whenever the condition of the live stock in said county requires the expenditure of money to prevent the spread of disease. Said tax shall be levied and collected by the several counties and paid to the county treasurer, in the manner provided by law for the levying, collection and payment of other county taxes. Said fund shall constitute the indemnity fund specified by this act to be used in paying for animals destroyed under the provisions thereof, and shall be used exclusively for that purpose. Said special tax shall be assessed upon all live stock found grazing in said county or counties, and notwithstanding the fact that the owner or person in charge may exhibit a tax receipt from some other State or Territory.

SEC. 16. All persons other than butchers, who occasionally slaughter neat cattle for beef, shall exhibit the hide or hides of such cattle at the time and place the beef or any part thereof is offered for sale, and the county stock inspector is empowered to enforce this regulation and may compel all persons who slaughter neat cattle for beef to file with him a statement showing the number of cattle slaughtered, the time when and the place where. Any person violating this section is guilty of a misdemeanor.

SEC. 17. Every person who cruelly whips, beats, or otherwise unnecessarily ill-treats any animals, or who shall be detected running cattle or other stock with dogs from any watering place, hay bottom, haystack, or any cattle or stock range in this Territory, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined not less than fifty dollars nor more than one hundred dollars for each and every offense. All fines collected in accordance with this section shall be paid half to the officer enforcing the law and half into the county treasury of the county in which the offense was committed. The county stock-inspector may be authorized by the board of county commissioners to observe all violations of this section and to bring to justice all found violating said section, for which services he shall be paid such reasonable compensation as the board of county commissioners may direct.

SEC. 18. Any sheriff or other person or persons arresting any horse, cattle, or mule thief, highway robber, or person obstructing or attempting to obstruct any railroad track, or wrecking or attempting to wreck any railroad train in the Territory of Idaho, shall receive a reward of two hundred and fifty dollars, to be paid by the county where the offense was committed upon conviction and sentence of the offender to the Territorial penitentiary for the term of not less than one year.

SEC. 19. It shall be unlawful for any person in this Territory to sell any head of live stock without giving a written bill of sale therefor; and it shall be unlawful for any person in this Territory to purchase any head of live stock, without receiving a bill of sale therefor; such bill of sale shall contain a full description of all marks or brands, or either, on such live stock and must be witnessed by two reputable citizens of the Territory, acknowledged before a notary public or other officer authorized to use a seal, and must be recorded in the office of the county recorder in the same manner that deeds are recorded.

SEC. 20. All acts and parts of acts in conflict with this act are hereby repealed.

SEC. 21. This act shall take effect and be in force from and after its passage.

Approved, February 7, 1889.

ILLINOIS.

AN ACT to define the duties of railroad, steamboat, transportation, and stock-yard companies under proclamations of the governor, scheduling territory on account of splenic or Texas fever among cattle.

Be it enacted by the people of the State of Illinois represented in the general assembly: That, during the time specified by any proclamation of the governor of this State restraining the importation of cattle from any territory therein scheduled, on account of splenic or Texas fever, all railroad, steamboat, and transportation companies in this State transporting such cattle into or through this State, or that shall receive or ship such cattle that have, prior to such shipment, been shipped or driven out of such scheduled territory to the point where they are received by such railroad, steamboat, or transportation company, for transportation into or through this State, shall, by their waybill or bill of lading state explicitly the point from whence said cattle were originally shipped or derived.

SEC. 2. That all railroad, steamboat, and transportation companies that shall so receive and ship such cattle, shall, immediately after the said cattle are unloaded, and before the said cars are used for any other purpose, cleanse and disinfect such cars or quarters in which the same are shipped, in accordance with the rules and regulations that may hereafter be presented by the board of live-stock commissioners of the State of Illinois, and approved by the governor.

SEC. 3. That all railroad, steamboat, and transportation companies that shall hereafter unload any such cattle in any yards along the line of their said roads or routes of travel, shall unload such cattle in pens set apart especially for such cattle, and shall allow no other cattle to enter into or be placed in such pens.

SEC. 4. All stock-yard companies in the State of Illinois receiving cattle shall set apart certain portions of their yards for the cattle described in the above sections, and shall conspicuously mark same, and shall provide separate chutes, alleys, and scales for such cattle; and where the waybills or bills of lading of the railroads delivering the same show that they are the kind of cattle before described they shall be placed in that portion of the yards set apart for such cattle, and in no case shall such cattle be unloaded by any railroad, steamboat, or transportation company in yards or pens other than those set apart for the exclusive receiving and yarding of such cattle.

SEC. 5. Any railroad, steamboat, transportation, or stock-yard company violating any of the provisions of this act, or any of the rules of the board of live-stock commissioners referred to herein, or relating to the transportation of cattle from territory scheduled by the governor on account of splenic or Texas fever, shall be fined in any sum not exceeding one thousand dollars for each offense. Such fines shall be recovered by action of debt in the name of the people of the State of Illinois, and shall be paid into the county treasury of the county in which the suit is brought. It shall be the duty of the State's attorney of any county in which suit may be brought to begin and prosecute any action for the recovery of the penalty herein provided upon request of the board of live-stock commissioners of Illinois; and it shall be the duty of any person having knowledge of a violation of any of the provisions of this act to report the same to said board.

Whereas an emergency exists, therefore, this act shall take effect and be in force from and after its passage.

Approved and in force May 28, 1889.

MAINE.

AN ACT to prevent fraud in the sale of lard.

SECTION 1. No manufacturer or other person shall sell, deliver, prepare, put up, expose, or offer for sale any lard, or any article intended for use as lard which contains any ingredient but the pure fat of swine, in any tierce, bucket, pail, or other vessel or wrapper, or under any label bearing the words "pure," "refined," "family," or either of them alone or in combination with other words unless every vessel, wrapper, or label, in or under which such article is sold or exposed, delivered or prepared, put up or exposed for sale, bears on the top or outer side thereof, in plain letters not less than one-half inch in length and plainly exposed to view, the words "compound lard."

SEC. 2. Any person who violates any provision hereof shall forfeit the sum of fifty dollars to the use of any person suing therefor, in an action of debt.

Approved, March 2, 1889.

CRUELTY TO ANIMALS.

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SEC. 29. Every person who cruelly overdrives, overloads, or overworks, who torments, tortures, maims, wounds, or deprives of necessary sustenance, or who cruelly beats, mutilates, or kills any horse or other animal, or causes the same to be done, or, having the charge or custody thereof, as owner or otherwise, unnecessarily fails to provide such animal with proper food, drink, shelter, and protection from the weather; every person owning or having the charge or custody of any animal, who knowingly and willfully authorizes or permits the same to suffer torture or cruelty; and every owner, driver, possessor, or person having the custody of an old, maimed, disabled, or diseased animal, who cruelly works the same when unfit for labor, or cruelly abandons such animal; and every person who carries or causes to be carried, in or upon a vehicle or otherwise, any animal in a wanton, cruel, or inhuman manner, shall, for every such offense, be punished by imprisonment in jail not exceeding one year, or by fine not exceeding two hundred dollars, or both.

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SEC. 35. (Amended 1891, chapter 25.) Railroad companies within the State shall give cars containing cattle, sheep, swine, or other animals a continuous passage in preference to other freight; and cars loaded with such animals at any station shall have precedence over all other freight. A greater number of animals shall not be loaded into any car than can stand comfortably therein. Animals of one kind only shall be loaded in one apartment. Young animals shall not be loaded in the same apartment with those larger and mature, except in case of dams with their own and others' sucklings, which shall in all cases be transported in the same apartment and separate from other animals. Calves shall have free access to their dams, and shall not be muzzled. During December, January, February, and March, cars used for the transportation of animals shall be sufficiently boarded on the sides and ends to afford proper protection to such animals in case of storms or severely cold weather.

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SEC. 41. Any officer or agent of any society for the prevention of cruelty to animals may lawfully cause to be destroyed forthwith any animal found abandoned and not properly cared for, appearing, in the judgment of two reputable persons called by him to view the same in his presence, to be diseased or injured past recovery for any lawful purpose.

SEC. 42 (as amended 1889, chapter 289). Such officer or agent may take possession of any old, maimed, disabled, diseased, or injured animal not properly cared for, and apply to any municipal or police court or trial justice for process to cause the same to be destroyed. If the owner is known, a copy of such application shall be served upon him in hand with an order of court to appear at a time and place named to show cause why such animal should not be destroyed and its value fixed. If the owner is not known, then the court shall order notices to be posted in two public and conspicuous places in the town, stating the case in substance, and giving forty-eight hours' notice of the hearing thereon. At such hearings the court shall determine the value of such animal, and may issue process directing such officer to destroy the same. The defendant may appeal as in civil actions.

SEC. 43. Such officer or agent may lawfully interfere to prevent the perpetration of any act of cruelty upon an animal in his presence, and whoever interferes with or obstructs such officer or agent in the discharge of his duty is guilty of a misdemeanor.

SEC. 44. Any person may take charge of an animal whose owner has cruelly abandoned it or cruelly fails properly to take care of and provide for it, and may furnish the same with proper shelter, nourishment, and care, at the owner's expense, and have a lien thereon for the same.

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SEC. 46. (Amended 1891, chapter 93.) Upon application b the mayor and aldermen of any city, the selectmen of any town, or the president and any three directors of any such company, the governor and council shall issue a badge and commission to any person designated to arrest any person charged with violating any of the preceding seventeen sections, the same as any sheriff, deputy sheriff, or constable can do, and whose jurisdiction shall extend throughout the State.

SEC. 47 (as amended 1885, chapter 364). Municipal and police courts and trial justices shall, on complaint, cause to be arrested persons charged with the commission, in their counties, of any of the offenses described in the eighteen preceding sections; and when such offenses are not of a high and aggravated nature may try and punish by fine not exceeding twenty dollars, and by imprisonment not exceeding thirty days; but when, on examination, the offense appears to be one not within their jurisdiction for trial, they may cause the person or persons charged with the commission of the same to recognize with sureties to appear before the supreme judicial court or superior court, and in default thereof, except in case of corporations, to be committed to jail.

MARYLAND.

AN ACT to prevent the spread of contagious or infectious diseases among the live stock of this State.

SECTION 1. *Be it enacted by the general assembly of Maryland*, That a commission is hereby established, which shall be known under the name and style of the "State live-stock sanitary board," to consist of three commissioners who are practically engaged in the breeding of live stock, who shall be appointed by the governor, by and with the advice and consent of the senate, biennially, at such time as executive appointments are required by law to be made, and who shall hold their offices until their successors are duly appointed and qualified.

SEC. 2. *And be it enacted,* That it shall be the duty of said board, as far as possible, to protect the health of the domestic animals of the State from all exotic contagious or infectious diseases and glanders in horses, and for this purpose it is authorized and empowered to establish, maintain, and enforce such quarantine, sanitary, or other regulations as it may deem necessary, and shall maintain an office in the city of Baltimore; it shall institute and prosecute diligent inquiries in the several counties, and ascertain as far as possible the exact condition of the health of the live stock in said counties, and the local boards of health of the several counties shall investigate all reported cases of contagious or infectious diseases of live stock in their respective counties, and if found to be contagious or infectious shall report the same at once to the said live stock sanitary board, and such board shall have the power to prevent the introduction into this State of animals from other States which they may have reason to believe are affected with a contagious or infectious disease, or have been exposed thereto, and to detain the same at any place for inspection or quarantine in its discretion.

SEC. 3. *And be it enacted,* That on presentation to the governor by the said "live stock sanitary board" of the facts, showing the existence of any contagious or infectious disease among the domestic animals of any other State, Territory, or district, the governor may by proclamation declare such State, Territory, or district, or any part thereof, in quarantine, and during the pendency of such quarantine it shall not be lawful for any person or persons, company, or corporation to bring into the State of Maryland any animal or animals of the kind so infected from the district so quarantined. And any person or persons, company or corporation, whether owner, agent, or carrier, convicted of a violation of the provisions of this section, shall be subject to a fine of not less than one hundred dollars nor more than five hundred dollars for each offense.

SEC. 4. *And be it enacted,* That each member of said board shall be paid the sum of five dollars per day and necessary expenses for time actually spent in the discharge of his duties. And the sum of three thousand dollars per year be, and the same is hereby, appropriated, or so much thereof as may be necessary, to meet the expenses of said board, including rent, printing, counsel fees, etc.

SEC. 5. *And be it enacted,* That the governor shall also appoint a chief veterinary inspector, who shall be a graduate in good standing of some recognized school of veterinary medicine, who shall hold his office and be paid a salary not exceeding one thousand dollars and traveling expenses, in the discretion of the governor, whose duty it shall be to visit the stables of the city and counties wherever and whenever he has reason to believe contagious or infectious disease may exist, and he may visit any such stable at any hour of the day, between sunrise and sunset and shall have power, with the consent of said live stock sanitary board, to order all animals which have been exposed to such contagion or infection to be isolated in such manner as the nature thereof may in his judgment render necessary to prevent the spreading of such disease; to order that any premises, farm or farms, stables or railway cars, where such disease exists, or has existed, be put in quarantine, so that no domestic animals of the same species shall be removed from or brought to the premises or place so quarantined until the same shall have been properly disinfected; to prescribe such regulations as he may judge necessary or expedient to prevent infection or contagion being communicated in any way from the place so quarantined; to call upon all sheriffs and deputy sheriffs, constables, policemen, or other officers of the State, the city of Baltimore, or of any county, for information and assistance to carry out and enforce the provisions of such orders and regulations; to prescribe regulations for the destruction of animals affected with or exposed to an infectious or contagious disease, and for the proper destruction of their hides and carcasses, and all objects which might carry infection or contagion; to prescribe regulations for the disinfection of all buildings, premises, and railway cars, and of all objects from which or by which infection or contagion might take place or be conveyed; to alter and modify from time to time, as he may deem expedient, the terms of all such orders and regulations, and to cancel or withdraw the same at any time; and it shall be the duty of all sheriffs and deputy sheriffs, constables, policemen, or other officers of the State, city of Baltimore, or counties to obey and observe all orders and instructions which they may receive from said veterinary inspector in the enforcement of the provisions of this act within their respective jurisdiction.

SEC. 6. *And be it enacted,* That any person who shall violate or transgress the terms or requirements of any order or regulation issued and prescribed by the said veterinary inspector, with the consent of the said live stock sanitary board, under the authority of this act, or shall refuse to said veterinary inspector or his assistants access to his, her, or their premises, farms, stables, cars, sheds, or pens, or shall resist said inspector or his assistants in applying any of the quarantine orders or regulations, or shall conceal the fact that contagious or infectious disease exists on his premises, shall be subject to a fine of not more than one hundred nor less than fifty dollars, which fine may be imposed by any justice of the peace of the city of Baltimore or any county where such offense may be committed.

SEC. 7. *And be it enacted,* That it shall be the duty of all persons practicing veterinary medicine in this State to report immediately to said board all cases of contagious or infectious disease among live stock which may come to their knowledge, and a failure to so report for forty-eight hours after he or they shall come into such knowledge shall be deemed a misdemeanor, and on conviction thereof he or they shall be fined not exceeding fifty dollars for each offense.

SEC. 8. *And be it enacted,* That it shall be unlawful for any person to inoculate any animal in this State with the virus of any infectious or contagious disease incident to animals without the consent of the said live-stock sanitary board, and that any person convicted of this offense shall be fined a sum not less than one nor more than five hundred dollars, in the discretion of the court.

SEC. 9. *And be it enacted,* That for the performance of the duties imposed on them by this act, all constables, sheriffs, or deputy sheriffs, or other State officers, shall be paid as for the performance of similar duties under existing laws.

SEC. 10. *And be it enacted,* That it shall be the duty of all State's attorneys to prosecute all persons accused of violating the provisions of this act, and to defend in all cases of appeals from appraisements.

SEC. 11. *And be it enacted,* That all rules and regulations formulated and issued by said board in pursuance of the powers hereby conferred on it, shall have the force and effect of laws, and all violations of such rules and regulations shall be punished as misdemeanors are punished at common law, and all appraisements of animals to be slaughtered, or of buildings to be destroyed, shall be approved by said board before such animals are slaughtered, or such buildings are destroyed; and said board shall have the discretion to have such animals slaughtered or quarantined.

SEC. 12. *And be it enacted,* That any person who shall sell or otherwise dispose of an animal which he knows, or has good reason to believe, is affected with any contagious or infectious disease, or has been exposed thereto within ninety days, or shall permit the same to pass over or upon any public highway, street, lane, or alley, or to graze any unfenced lot or piece of ground without the consent of the said board, shall, on conviction thereof, be fined not less than fifty dollars nor more than one hundred dollars for each animal so driven or exposed; such fine may be imposed by any justice of the peace of the city of Baltimore or county where the offense shall be committed.

SEC. 13. *And be it enacted,* That it shall be unlawful for any person or persons to wilfully expose any animal to others affected with a contagious or infectious disease, or to put or suffer to be put any healthy or unexposed animal of the same species into any stable, or on any premises which have been declared to be infected, until the same shall have been declared to be free from such infection by the said veterinary inspector, with the consent of said board. Any person or persons convicted of violating any of the provisions of this section shall be subject to a fine of not less than one nor more than five hundred dollars for each offense; and the animal or animals so introduced into such infected stables or premises shall be slaughtered by said veterinary inspector without appraisement or compensation from the State.

SEC. 14. *And be it enacted,* That in the event of any building or buildings, sheds, stables, stable furniture, hay, straw, or fodder, being reported to the said board by said inspector as being incapable of proper disinfection, the said board may, in its discretion, have such buildings and articles so infected appraised as hereinafter provided for the appraisement of animals, and destroyed.

SEC. 15. *And be it enacted,* That in the event of its being deemed necessary for the said veterinary inspector and said board to prevent the spread of contagious or infectious disease, or to cause any animal or animals so diseased or exposed to such disease to be slaughtered, the value of such animal or animals shall be appraised in their then condition by two sworn appraisers, to be sworn before any officer authorized to administer oaths and affirmations, one of which appraisers to be appointed by the owner or custodian of such animals, the other by the said veterinary inspector, or in case the said owner or custodian of such animals shall neglect or refuse to name such appraisers, then by two appraisers to be appointed by said inspector, who, in case of disagreement, shall call in a third, which said appraisement, when approved by said board, shall be filed with the comptroller, and the comptroller shall forthwith issue his warrant to the treasurer for the amount of said appraisement in favor of the said owner or owners, and if the owner or owners of such animals or buildings or other property shall not be satisfied with the amount of said appraisement, he or they may, within sixty days, appeal to the circuit court of the county, or to the Baltimore City court, if such animals or buildings are within the city of Baltimore, by filing in said court a copy of such appraisement with a petition for writ of subpœna against the said veterinary inspector, which appeals shall be acted on by said court in the same manner as appeals from justices of the peace.

SEC. 16. *And be it enacted*, That the said board is hereby authorized and empowered to agree with the Bureau of Animal Industry of the Department of Agriculture of the United States, or other properly constituted authority of the United States, for coöperation in the work of eradicating any contagious or infectious disease among live stock, in the State of Maryland, but such agreement shall provide that such work shall be under the control of the State authorities.

SEC. 17. *And be it enacted*, That in event of an epidemic of contagious or infectious disease among the live stock of this State, it shall be the duty of the said board to appoint such assistants to said inspector as may be necessary to promptly suppress the same and to fix their pay.

SEC. 18. *And be it enacted*, That all diseased animals, that under the provisions of this act shall be slaughtered at any slaughter house where meat is prepared for market, shall be slaughtered under the supervision of the chief veterinary inspector, or his assistants, and it shall be the duty of said inspector to see that the carcasses and offal of such diseased animals, whether such disease is contagious or otherwise, are destroyed and not sold for food, and any inspector who shall corruptly pass as healthy a diseased animal shall on conviction thereof be fined not exceeding five hundred dollars and forfeit his commission.

SEC. 19. *And be it enacted*, That all acts or parts of acts inconsistent with this act be, and they are hereby, repealed, providing nothing herein shall affect the commissions or terms of office of the chief veterinary inspector and members of said sanitary board appointed and confirmed at this session of the general assembly, nor shall any prosecution now pending for violation of the acts of eighteen hundred and eighty-four, chapter one hundred and fifty-seven, and eighteen hundred and eighty-six, chapter eighty, abate, but the same shall be prosecuted to final judgment under the provisions of said acts as if this act had not been passed.

SEC. 20. *And be it enacted*, That this act shall take effect from the date of its passage.

Approved, this 5th day of April, 1888.

MICHIGAN.

AN ACT to provide for the appointment of a live-stock sanitary commission and a State veterinarian, and to prescribe their powers and duties, and to prevent and suppress contagious and infectious diseases among the live stock of the State, approved June 10, 1885.

[Act No. 182, laws of 1885, as amended by act No. 47, approved March 26, 1887; act No. 105, approved May 13, 1887, and act No. 125, approved May 31, 1889.]

The people of the State of Michigan enact, That a commission is hereby established which shall be known under the name and style of "The State Live-Stock Sanitary Commission." The commission shall consist of three commissioners who are practical agriculturists and engaged in the live-stock industries of the State, who shall be appointed by the governor with the advice and consent of the senate. One shall be appointed for the term of six years, one for the term of four years, and one for the term of two years, whose term of office shall commence on the second Tuesday of July of the year in which they are appointed, and shall continue until their successors are appointed and qualified. And at each succeeding biennial session of the legislature there shall be appointed in like manner one commissioner who shall hold his office six years, or until his successor is appointed and qualified. The governor shall also appoint, with the advice and consent of the senate, a competent and skilled veterinary surgeon for the State, who, at the time of such appointment shall be a graduate in good standing of a recognized college of veterinary surgery, and who shall hold his office two years from the second Tuesday of July of the year he is appointed and until his successor is appointed and qualified. The governor shall also appoint every two years thereafter a competent and skilled veterinarian having the qualifications above mentioned, whose term of office shall be for two years, or until his successor is appointed and qualified.

SEC. 2. Said commissioners and veterinary surgeon before they enter upon the duties of their office shall each take and subscribe the constitutional oath of office and file the same with the secretary of state.

SEC. 3. Each commissioner shall receive the sum of three dollars per day and necessary expenses for the time actually spent in the discharge of his duties; and the veterinary surgeon shall receive the sum of five dollars per day and necessary expenses for time when employed.

SEC. 4. It shall be the duty of the commission to protect the health of the domestic animals of the State from all contagious or infectious diseases of a malignant character, and for this purpose it is hereby authorized and empowered to establish, maintain, and enforce such quarantine, sanitary, and other regulations as it may deem necessary.

SEC. 5*. It shall be the duty of any person who discovers, suspects, or has reason to believe that any domestic animal belonging to him or in his charge, or that may come under his observation, belonging to other parties, is affected with any disease, whether it be a contagious or infectious disease, to immediately report such fact, belief, or suspicion to the live stock sanitary commission, or a member thereof, or to the local board of health or some member thereof.

SEC. 6.† It is hereby made the duty of all local boards of health to whom cases of contagious or infectious diseases are reported, to immediately investigate the same, either in person by some member or members of the board, or by the employment of a competent and skilled veterinarian; and should such investigation show a reasonable probability that a domestic animal is affected with a contagious or infectious disease of a malignant character, the local board of health shall immediately establish such temporary quarantine as may be necessary to prevent the spread of the disease and report all action taken to the commission or to some member thereof; and the acts of local boards of health establishing temporary quarantine shall have the same force and effect as though established by the commission itself, until such time as the commission may take charge of the case or cases, and relieve the local board of health. All expenses incurred by local boards of health in carrying out the provisions of this act shall be paid in like manner as are other expenses incurred by said boards in the discharge of other official duties.

SEC. 7. The commission or any member thereof to whom the existence of any infectious or contagious disease of domestic animals is reported shall forthwith proceed to the place where such domestic animal or animals are and examine the same, and if in his or their opinion any infectious or contagious disease does exist, he or they shall prescribe such temporary quarantine and regulations as will prevent the spread of the contagion or infection, and notify the State veterinarian, who shall forthwith proceed to the place where said contagious or infectious disease is said to exist and examine said animal or animals and report his or their finding to the said commission, who then shall prescribe such rules and regulations as in their judgment the exigencies of the case may require for the effectual suppression and eradication of the disease; and for that purpose the said commission may list and describe the domestic animals affected with such disease and those which have been exposed thereto and included within the infected district or premises, so defined and quarantined with such reasonable certainty as would lead to their identification, and no domestic animal liable to become infected with the disease or capable of communicating the same shall be permitted to enter or leave the district, premises, or grounds so quarantined, except by the authority of the commission. The said commission shall also, from time to time, give and enforce such directions, and prescribe such rules and regulations as to separating, mode of handling, treating, feeding, and caring for such diseased and exposed animals as it shall deem necessary to prevent the two classes of animals from coming in contact with each other, and perfectly isolate them from all other domestic animals which have not been exposed thereto and which are susceptible of becoming infected with the disease, and the said commission and veterinarian are hereby authorized and empowered to enter upon any grounds or premises to carry out the provisions of this act. When in the opinion of the commission it shall be necessary to prevent the further spread of any contagious or infectious disease among the live stock of the State, to destroy animals affected with or which have been exposed to any such disease, it shall determine what animals shall be killed, and appraise the same, as hereinafter provided, and cause the same to be killed and the carcasses disposed of as in their judgment will best protect the health of domestic animals of the locality.

SEC. 8. When the commission shall have determined the quarantine and other regulations necessary to prevent the spread among domestic animals of any malignant, contagious, or infectious disease found to exist among the live stock of the State, and given their order as hereinbefore provided, prescribing quarantine and other regulations, it shall notify the governor thereof, who shall issue his proclamation, proclaiming the boundary of such quarantine and the orders, rules, and regulations prescribed by the commission, which proclamation may be published by written or printed handbills posted within the boundaries or on the lines of the district, premises, places, or grounds quarantined: *Provided,* That if the commission decide that it is not necessary, by reason of the limited extent of the district in which such disease exists, that a proclamation should be issued, then none shall be issued, but such commission shall give such notice as may to it seem best to make the quarantine established by it effective.

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* As amended by act No. 105, Public Acts, 1887, and act No. 125, Public Acts, 1889.

† The original section 6 was repealed by act No. 105, Public Acts, 1887. A new section, to stand as section 6, was enacted by act No. 125, Public Acts, 1889.

SEC. 9. Whenever the commission shall direct the killing of any domestic animal or animals, it shall be the duty of the commissioners to appraise the animal or animals condemned, and in fixing the value thereof the commissioners shall be governed by the value of said animal or animals at the date of appraisement.

SEC. 10. Whenever any live stock shall be appraised and killed by order of the commission, it shall issue to the owner of the stock so killed a certificate showing the number and kind of animals killed, and the amount, in their judgment, to which the owner is entitled, and report the same to the governor of the State, which certificate, if approved by the governor, shall be presented to the auditor-general, who shall draw his warrant on the State treasurer for the amount therein stated, payable out of any money in the treasury not otherwise appropriated.

SEC. 11. When any animal or animals are killed under the provisions of this act by order of the commission, the owner thereof shall be paid therefor the appraised value as fixed by the appraisement hereinbefore provided for: *Provided*, The right of indemnity on account of animals killed by order of the commission under the provisions of this act shall not extend to the owners of animals which have been brought into the State in a diseased condition, or from a State, country, Territory, or district in which the disease with which the animal is affected, or to which it has been exposed, exists. Nor shall any animal be paid for by the State which may be brought into the State in violation of any law or quarantine regulation thereof, or the owner of which shall have violated any of the provisions of this act, or disregarded any rule, regulation, or order of the live-stock sanitary commission, or any member thereof. Nor shall any animal be paid for by the State which came into the possession of the claimant with the claimant's knowledge that such animal was diseased, or was suspected of being diseased, or of having been exposed to any contagious or infectious disease.

SEC. 12.* Any person who shall have in his possession any domestic animal affected with any contagious or infectious disease, knowing such animal to be so affected, or, after having received notice that such animal is so affected, who shall permit such animal to run at large, or who shall keep such animal where other domestic animals not affected by or previously exposed to such disease may be exposed to its contagion or infection, or who shall sell, ship, drive, trade, or give away such diseased animal or animals which have been exposed to such contagion or infection, or who shall move or drive any domestic animal in violation of any direction, rule or regulation, or order establishing and regulating quarantine, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not less than ten dollars, nor more than one hundred dollars, or be imprisoned in the county jail not less than ten nor more than ninety days, or both such fine and imprisonment, in the discretion of the court, for each of such diseased or exposed domestic animals which he shall permit to run at large, or keep, sell, ship, drive, trade, or give away in violation of the provisions of this act.

SEC. 13.* Any person who shall knowingly bring into this State any domestic animal which is affected with any contagious or infectious disease, or any animal which has been exposed to any contagious or infectious disease, shall be deemed guilty of a misdemeanor, and, on conviction thereof, shall be fined in any sum not less than one hundred dollars, nor more than five thousand dollars, or be imprisoned in the State prison not to exceed one year, or both such fine and imprisonment, in the discretion of the court.

SEC. 14.* Any person who owns or is in possession of live stock which is affected, or which is suspected or reported to be affected, with any infectious or contagious disease, who shall wilfully prevent or refuse to allow the State veterinarian or commissioner or other authorized officer or officers to examine such stock, or shall hinder or obstruct the State veterinarian or other authorized officer or officers in any examination of, or in any attempt to examine such stock, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not less than ten dollars nor more than one hundred dollars, or be imprisoned in the county jail not less than ten nor more than ninety days, or both such fine and imprisonment, in the discretion of the court.

SEC. 15.* Any person who shall wilfully violate, disregard, or evade, or attempt to violate, disregard, or evade any of the provisions of this act, or who shall wilfully violate, disregard, or evade any of the rules, regulations, orders, or directions of the live-stock sanitary commission establishing and governing quarantine, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not less than ten dollars nor more than one hundred dollars, or be imprisoned in the county jail not less than ten nor more than ninety days, or both such fine and imprisonment, in the discretion of the court.

SEC. 16. The commission provided for in this act shall have power to employ at the expense of the State such persons and purchase such supplies and material as may be necessary to carry into full effect all orders by it given.

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* As amended by act No. 125, Public Acts, 1889.

SEC. 17. The commissioners shall have power to call upon any sheriff, undersheriff, deputy sheriff, or constable to execute their orders, and such officers shall obey the orders of said commissioners, and the officers performing such duties shall receive compensation therefor as is prescribed by law for like services, and shall be paid therefor in like manner. And any officer may arrest and take before any justice of the peace of the county any person found violating any of the provisions of this act, and such officer shall immediately notify the prosecuting attorney of such arrest, and he shall prosecute the person so offending according to law.

SEC. 18. Whenever the governor of the State shall have good reason to believe that any dangerous, contagious, or infectious disease has become epizoötic in certain localities in other States, Territories, or countries, or that there are conditions which render such domestic animals from such infected districts liable to convey such disease, he shall by proclamation prohibit the importation of any live stock of the kind diseased into the State, unless accompanied by a certificate of health given by a duly authorized veterinary surgeon; and all such animals arriving in this State shall be examined immediately by the commission or some member thereof, and if he or they deem necessary he or they shall have said animals inspected by the State veterinary surgeon, and if in his opinion there is any danger from contagion or infection, they shall be placed in close quarantine until such danger of infection or contagion is passed, when they shall be released by order of said commission or some member thereof.

SEC. 19. For the purpose of this act each member of the Live-Stock Sanitary Commission is hereby authorized and empowered to administer oaths and affirmations.

SEC. 20. This commission is hereby authorized and required to coöperate with any board or commission acting under any present or future act of Congress for the suppression and prevention of contagious or infectious diseases among domestic animals, and the same right of entry, inspection, and condemnation of diseased animals upon private premises is granted to the United States board or commission as is granted to the commission created under this act.

SEC. 21. The commission shall make biennially a detailed report of its doings to the governor, which report shall be transmitted to the legislature at its regular biennial session.

SEC. 22.* This act shall be construed so as to include sheep and horses.

Ordered to take immediate effect.

Approved, June 10, 1885.

SEC. 23.† Any railroad company, navigation company, or other corporation, or common carrier, who shall knowingly or willfully violate, disregard, or evade any of the provisions of this act, or who shall willfully violate, disregard or evade any of the rules, regulations, orders, or directions of the Live-Stock Sanitary Commission establishing or governing quarantine, or who shall evade, or attempt to evade any quarantine proclamation of the governor of this State declaring quarantine limits, shall forfeit and pay to the people of the State of Michigan not less than five hundred dollars, nor more than five thousand dollars, for each and every offense, and shall be liable for all damages caused to any neat cattle by its or his failure to comply with the requirements of this act.

This act is ordered to take immediate effect.

Approved, May 13, 1887.

AN ACT to regulate and provide for the carrying, yarding, and feeding of so-called Texas cattle while in transit into or across this State between the first day of April and the first day of November of each year.

[Act No. 198, Laws of 1885.]

The people of the State of Michigan enact, That it shall not be lawful to transport any neat cattle into or across this State, yard or feed the same, that have been reared or kept south of the thirty-sixth parallel of north latitude, and that have not subsequently been kept continuously at least one winter north of said parallel, and which may be brought within the limits of this State between the first day of April and the first day of November following, except in the manner hereafter provided.

SEC. 2. It shall be the duty of all railroad companies doing business in this State to receive and transport while in this State the class of cattle mentioned in section one only in cars that are branded or lettered legibly and distinctly and in plain view the words "For the transportation of Texas cattle only;" and they shall not permit or allow any other class of cattle to enter those cars between the first day of April and the first day of November following: *Provided*, That cattle coming from other States for transportation through this State, when it is impossible to ascertain where they came from, may be shipped in such cars, but shall be treated in all respects as coming from the country south of the thirty-sixth parallel of north latitude.

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* As amended by act No. 47, Public Acts of 1887.

† Section 23 was added by act No. 105, Public Acts of 1887.

SEC. 3. It shall be the duty of any railroad company, stock-yard company, or private individual owning and operating any stock yard in this State, to receive and feed the class of cattle mentioned in section one only in yards separate and apart from yards used for the feeding or yarding or other cattle; and these yards shall be in the immediate vicinity and contiguous to a railroad side track, so that these cattle may not pass over any open common that might be crossed by other cattle; and said yards shall have a sign post at each entrance thereto, on which shall be plainly lettered "For the yarding of Texas cattle only," and no other cattle shall be admitted to these yards between the first day of April and the first day of November of each year.

SEC. 4. Any railroad, stock-yard company, or private individual owning any stock yard in this State, who shall violate any of the provisions of sections one and two of this act, shall forfeit and pay to the people of the State of Michigan not less than fifty dollars nor more than five hundred dollars for each and every such offense, and shall be liable for any and all damages caused to any neat cattle by their failure to comply with the requirements of this act.

SEC. 5.* Any person or persons who shall knowingly or willfully place or attempt to place any neat cattle, other than those mentioned in section one, in any car or yard provided for in section two or three of this act, and branded and lettered as therein provided for between the first day of April and the first day of November following, shall be deemed guilty of a misdemeanor and on conviction thereof shall be fined not less than ten dollars nor more than one hundred dollars, or be imprisoned not less than ten days nor more than sixty days, or both such fine and imprisonment in the discretion of the court.

Approved, June 16, 1885.

MASSACHUSETTS.

AN ACT to prevent the spread of tuberculosis.

Be it enacted by the senate and house of representatives in general court assembled, and by the authority of the same, as follows: Section one of chapter fifty-eight of the Public Statutes is hereby amended by striking out the words "may annually," in the second line of said section, and inserting in place thereof the words "shall annually in the month of April" also by inserting after the word "slaughter," in the third line of said section, the words "or kept for the production of milk," so as to read as follows:

"Section 1. The mayor and aldermen of cities and the selectmen of towns shall, annually, in the month of April, appoint one or more persons to be inspectors of provisions and of animals intended for slaughter or kept for the production of milk. Such inspectors shall be sworn faithfully to discharge the duties of their office, and shall receive such compensation as the city council or the selectmen shall determine."

SEC. 2. Said inspectors, in addition to the powers conferred upon them by section two of chapter fifty-eight of the Public Statutes, may inspect all animals kept for the production of milk, and shall report to the board of cattle commissioners all suspected cases of tuberculosis which come to their notice among animals intended for slaughter or kept for the production of milk.

SEC. 3. Section thirteen of chapter two hundred and fifty-two of the acts of the year eighteen hundred and eighty-seven is hereby amended by inserting after the word "of," in the ninth line of said section, the word "tuberculosis," and by adding, at the end of said section, the words "and may also pay a reasonable sum for the animal destroyed, should a post-mortem examination prove that said animal was free from the disease for which it was condemned," so as to read as follows:

"Section. 13. When the commissioners, by an examination of a case of contagious disease among domestic animals, become satisfied that it has been contracted by intention or negligence on the part of the owner, or of a person in his employ, or by his consent, or by the use of food material liable to contain the germs of contagion, they shall cause such animals to be securely isolated at the expense of the owner, or they shall cause them to be killed without appraisal or payment; and in all cases of tuberculosis, farcy, or glanders, the commissioner having condemned the animal infected therewith, shall cause such animal to be killed without an appraisal, but may pay the owner or any other person an equitable sum for the killing and burial thereof, and may also pay a reasonable sum for the animal destroyed, should a post-mortem examination prove that said animal was free from the disease for which it was condemned."

SEC. 4. Section seven of chapter fifty-eight of the Public Statutes is hereby repealed.

SEC. 5. This act shall take effect upon its passage.

Approved, April 22, 1892.

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* As amended by act No. 57, Laws of 1887.

AN ACT relative to the prevention of the spread of tuberculosis.

Be it enacted by the Senate and House of Representatives in general court assembled, and by the authority of the same, as follows: Section one of chapter fifty-eight of the Public Statutes as amended by section one of chapter one hundred and ninety-five of the acts of the year eighteen hundred and ninety-two is hereby amended by inserting after the word "shall," in the second line of said section as amended, the words "in the month of July, in the year eighteen hundred and ninety-two, and thereafter," so as to read as follows:

Section 1. The mayor and aldermen of cities and the selectmen of towns shall in the month of July, in the year eighteen hundred and ninety-two, and thereafter annually in the month of April, appoint one or more persons to be inspectors of provisions and of animals intended for slaughter or kept for the production of milk. Such inspectors shall be sworn faithfully to discharge the duties of their office and shall receive such compensation as the city council or the selectmen shall determine."

SEC. 2. This act shall take effect upon its passage.

Approved, June 16, 1892.

MONTANA.

AN ACT to provide for the appointment of deputy veterinary surgeons, and to suppress and prevent the dissemination of scab and contagious diseases among sheep.

Be it enacted by the legislative assembly of the Territory of Montana, That the Territorial veterinary surgeon, upon the request of the president or secretary of any organized wool-growers' association in any county in Montana, or of any three sheep owners in any county therein, shall appoint a capable and discreet person as deputy inspector in such county, who shall hold his office during the pleasure of such veterinary surgeon, and shall perform such duties as are hereinafter prescribed.

SEC. 2. Such deputy shall be a resident of the county for which he shall be appointed. He shall, before entering upon the duties of his office, take the oath prescribed by section one thousand and sixty-seven, fifth division, general laws of Montana.

SEC. 3. It shall be the duty of each deputy inspector so appointed to inspect all sheep within his county of which he may receive notice as provided in section four of this act, and in case the same be not diseased, he shall make and issue a certificate stating such fact. But if the sheep are diseased, or have been herded upon the range or in corrals which have within the past ninety days been used or occupied by any diseased or infected sheep, the regulation for their quarantine, holding, and keeping shall at once be made by such deputy. Each deputy inspector so appointed shall personally supervise the dipping of every band of scabby sheep within his county, and have the appointing of the date for each and every dipping; he shall have the right to determine and superintend the proportion and mixture of materials, and shall cause sheep quarantined to be distinctly marked.

SEC. 4. Upon receipt of reliable information, in writing, that any sheep in his county are infected with scab, or any infectious disease, or have recently been herded upon the range of, or occupied corrals which have within the past ninety days been used or occupied by any infected or diseased sheep, such deputy inspector shall immediately cause the diseased sheep, and all sheep running in the same flock with them, to be examined, and if found so diseased, to be quarantined, and held within a certain limit or place, to be defined by him, and such sheep shall be held in quarantine until the owner or person in charge shall have eradicated such scab or infectious disease effectually. The expense of feeding, holding, dipping, marking, and taking care of all sheep quarantined under the provisions of this act shall be paid by the owner, agent, or person in charge of such sheep.

SEC. 5. Whenever the governor shall, by proclamation, quarantine for inspection, as provided may be done in the next section, any sheep brought into Montana, it shall then be the duty of the deputy inspector of the county in which such sheep may come to immediately inspect the same, and if he finds that they are infected with scab, or any other infectious disease, he shall cause the same to be held within a certain limit or place in said county, to be defined by him, until such disease shall be eradicated, as provided in section four of this act.

SEC. 6. Whenever the governor of the Territory shall have good reason to believe that any disease covered by this act has become epidemic in certain localities in any other State or Territory, or that conditions exist that render sheep liable to convey disease he shall thereupon, by proclamation, schedule such localities and prohibit the importation from them of any sheep into this Territory except under such restrictions as he, after consultation with the veterinary surgeon, may deem proper. Any corporation, person or persons who, after publication of such proclamation, shall knowingly receive in charge any such sheep from any of the said prohibited districts and transport or convey the same within the limits of any of the said counties of this Territory, shall be deemed guilty of a misdemeanor, and upon conviction be fined not less than five hundred dollars nor more than one thousand dollars for each and every offense; and shall further be liable for any and all damages and loss that may be sustained by any person or persons by reason of the importation or transportation of such prohibited sheep.

SEC. 7. Upon issuing such proclamation mentioned in section six of this act it is hereby made the duty of the owners or persons in charge of any sheep being shipped into Montana against which quarantine has been declared to notify the deputy inspector of the county in which such sheep shall first come, without delay, of such arrival, and such owner or person in charge shall not allow any sheep so quarantined to pass over or upon any public highway or upon the ranges occupied by any other sheep, or within five miles of any corral in which sheep are regularly corralled, until such sheep shall have first been inspected, and any person failing to comply with the provisions of this section shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in a sum not less than two hundred and fifty dollars nor more than one thousand dollars, and shall be liable in damages for any loss sustained by any person by reason of the failure to comply with the provisions of this section.

SEC. 8. In no case shall any scabby sheep be allowed to be removed from any one point to another within any of said counties or from one county to another, or any sheep that have been within one year scabby, without a written certificate from the said sheep-inspector, provided such sheep may be transferred and removed with the written consent of all sheep-owners or managers along the route and in the vicinity of the proposed location, except those mentioned in the preceding section. Any person violating the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not less than two hundred and fifty dollars nor more than one thousand dollars for each and every offense.

SEC. 9. Upon the arrival of any flock of sheep in this Territory, or into any county of this Territory from any other country, State, or Territory, the owner or agent in charge shall immediately report them to the deputy inspector of the county in which such sheep shall first come for inspection, and such deputy shall immediately inspect the same. And in case of failure from any cause of the owner or agent to report for inspection, such person so offending shall, upon conviction thereof, be fined in any sum not less than two hundred and fifty dollars nor more than one thousand dollars. The expense of such inspection shall be borne by the owner of the sheep, and shall be a lien against any and all such sheep.

SEC. 10. The deputy inspector in each county shall receive for his services whilst necessarily employed in inspection eight dollars per diem, which shall include all traveling expenses of whatever kind or nature incurred in going to or from the places where such inspection is had: *Provided, however*, That when any deputy veterinary surgeon appointed under the provisions of section sixty-two, fifth division, general laws of Montana, it shall be his duty, when notified and called upon, to perform such duties as are herein imposed upon deputy inspectors, and for services rendered under the provisions of the last preceding section he shall in all cases without fail collect from the owner or agent the same fees as are allowed deputy inspectors in such cases, but in no other case shall he be allowed to charge or collect from any sheep-owner any fees.

SEC. 11. Whenever any deputy inspector shall file in the office of the Territorial auditor proper vouchers duly approved by the veterinary surgeon, setting forth (1) the name in full of such deputy inspector; (2) the kind and nature of the services rendered; (3) the particular locality where such work was done; (4) the time when and the length of time employed; (5) the number of sheep inspected and the name of the owner or person in charge; (6) the diseases treated and the number treated for each disease, and the length of time of such treatment and the result; (7) the amount claimed and the value of such services, such auditor shall proceed to audit the same, and if found correct shall draw his warrant in favor of such deputy inspector, payable out of any moneys in the "sheep inspectors" and "indemnity fund" of the Territory.

SEC. 12. Every deputy appointed under the provisions of this act shall keep a book, to be known as the "inspection record," in which he shall enter and record all his official acts and proceedings. Such record shall particularly show the name of the owner of each flock of sheep inspected, when the same was inspected, and the number in each flock, the result of such inspection, the names of persons to whom certificates have been granted and when, and all orders and directions made in relation to any matters herein designated.

SEC. 13. Any person who shall fail to comply with, or shall disregard any order or direction made by any deputy inspector under the provisions of this act, shall, upon conviction, be fined in any sum not less than one hundred dollars nor more than five hundred dollars.

SEC. 14. It shall be unlawful for any person or persons to bring into Montana Territory from without said Territory any sheep infected with scab or any other contagious disease. Every person offending shall, upon conviction thereof, be fined in any sum not less than one hundred dollars nor more than five hundred dollars, or imprisoned in the county jail not less than one month nor more than three months, or both such fine and imprisonment, at the discretion of the court.

SEC. 15. No property shall be exempt from execution issued upon any judgment obtained under any of the provisions of this act.

SEC. 16. Whenever in the opinion of the veterinary surgeon it shall be necessary to have more than one deputy inspector in a county he shall immediately make the appointment and define as near as may be the particular portion of the county in which such deputy shall perform his duties, and any deputy appointed under the provisions of this act who shall, under and by virtue of the powers conferred upon him by reason of such appointment, oppress, wrong, or injure any person or persons, shall, upon conviction, be fined in any sum not less than one hundred dollars nor more than five hundred dollars.

SEC. 17. Sections two, three, and six of an act entitled "An act to prevent and suppress scab and infectious diseases among sheep," approved September fourteenth, eighteen hundred and eighty-seven, and sections sixty-seven, sixty-eight, and sixty-nine of chapter four, fifth division, general laws, are hereby repealed, and all other acts or parts of acts amendatory thereof and supplemental thereto which are in conflict with the provisions of this act are hereby modified to conform with the provisions of this act: *Provided, however,* That nothing in this act shall be construed so as to prevent any officer from fully performing the duties required of him under the provisions of the unrepealed sections of the acts last above referred to.

SEC. 18. This act shall take effect and be in force from and after its passage.

Approved, March 14, 1889.

MISSOURI.

AN ACT to amend article 3, chapter 167, sections 8775, 8776, 8777, 8778, 8779, 8781, 8782, 8783, 8790, 8791, 8793, and 8794 of the Revised Statutes of the State of Missouri of 1889.

Be it enacted by the general assembly of the State of Missouri as follows: Amend section eighty-seven hundred and seventy-five, article three, chapter one hundred and sixty-seven, Revised Statutes, eighteen hundred and eighty-nine, by striking out the words "the board of curators or trustees in control of the State agricultural college," in the first and second lines of said section, and inserting in lieu thereof the words "the State board of agriculture," and by striking out the word "curators," in the sixth line of said section, and inserting in lieu thereof the words "said board of agriculture;" also, by striking out the word "curators," in the last line of said section, and inserting in lieu thereof the word "agriculture;" also, by adding after the word "office," in last line of said section, and before the word "until," in same line, the words "for a term of four years or," and inserting the words "for cause" between the words "curators" and "as," in the last line of said section; so that said section, when amended, shall read as follows:

"SEC. 8775. The State board of agriculture of the State of Missouri shall appoint a veterinary surgeon, to aid and assist in developing and protecting the live-stock interests of the State of Missouri. Said veterinary surgeon shall be a graduate of some reputable and recognized veterinary college or school, and shall give to the said board of agriculture, before his appointment, good evidence of a recognized, practical, and scientific knowledge of contagious and infectious diseases of live stock, and shall hold his office for a term of four years, or until removed by said board of agriculture for cause, as hereinafter provided.

SEC. 2. Amend section eighty-seven hundred and seventy-six, article three, chapter one hundred and sixty-seven, Revised Statutes, eighteen hundred and eighty-nine, by striking out the words "board of curators," where they occur in the second line of said section, and inserting in lieu thereof the following, "board of agriculture;" and also by striking out all of said section after the words "veterinary surgeon," where they occur in the fifth line of said section, and inserting in lieu thereof the following: "shall have his office with or near the office of the State board of agriculture; shall act only as an expert; and he shall, when practicable, devote all the time possible to the investigation of the nature of, causes of, and remedies for the diseases of domestic animals, and he may at any time, if he deems best and useful, cause scientific, practical investigations to be made, and shall teach the knowledge thus obtained from such investigation of the nature and causes of diseases and the results of such scientific, practical investigation to the students of the agricultural college, within the scope and meaning of this article. The secretary of the State board of agriculture shall assume charge of such clerical work pertaining to the veterinary service," so that said section, when amended, will read as follows:

"SEC. 8776. Said veterinary surgeon shall, before entering upon the discharge of his duty, file with said board of agriculture his oath of office, with a satisfactory and sufficient bond for the faithful performance of his duty, and for security for the public funds that he may in any way dispose of or draw upon. Said veterinary surgeon shall have his office with or near the office of the State board of agriculture; shall act only as an expert; and he shall, when practicable, devote all the time possible to the investigation of the nature of, causes of, and remedies for the diseases of domestic animals, and he may at any time if he deems best and useful, cause scientific, practical investigations to be made, and shall teach the knowledge thus obtained from such investigation of the nature and causes of diseases and the results of such scientific, practical investigation to the students of the agricultural college. The secretary of the State board of agriculture shall assume charge of all clerical work pertaining to the veterinary service."

SEC. 3. Amend section eighty seven hundred and seventy-seven, article three, chapter one hundred and sixty-seven, Revised Statutes, eighteen hundred and eighty-nine, by striking out the words "curators controlling the State Agricultural College," in the second and third lines of said section, and inserting in lieu thereof the words "State board of agriculture," and by inserting between the words "the" and "State," in the last line of said section, the words "veterinary service of the;" so that said section, when amended, will read as follows:

"SEC. 8777. Said veterinary surgeon shall be under the control of the State board of agriculture, who may remove him whenever in their judgment the good of the veterinary service of the State may demand it."

SEC. 4. Amend section eighty seven hundred and seventy-eight, article three, chapter one hundred and sixty-seven, Revised Statutes, eighteen hundred and eighty-nine, by striking out the words "To the State veterinary surgeon, State agricultural college," where they appear in the address in the form of petition in said section, and insert in lieu thereof the words "To the secretary of the State board of agriculture;" so that said section, when amended, will read as follows:

"SEC. 8778. It shall be lawful for any ten freeholders, residents of this State, to go before any clerk of a court of record or justice of the peace and demand the presence and services of said veterinary surgeon, in the following manner:

"'STATE OF MISSOURI, *County of* ———, *ss:*

"'*To the secretary of the State board of agriculture, Columbia, Mo.:*

"We, the undersigned citizens, freeholders of the county of ———, believe that there exists in this locality a dangerous infectious disease among (here name the kind of stock, the name in full of the party owning the same or in charge thereof, the part of the county in which it is situated, together with the nearest railroad station and post-office address, and full directions as to the best and most expeditious way for the veterinary surgeon to reach said stock); therefore, we request the presence of the State veterinary surgeon.

"'——— ——— [SEAL].
"'——— ——— [SEAL].'

"Which petition may be certified to in the following manner:

"'STATE OF MISSOURI, *County of* ———, *ss:*

"'I hereby certify that the above-named petitioners are known to be reputable citizens of this county.'"

(Signed by the clerk of said court or justice of the peace and attested by his official signature, giving day of the month and the year.)

SEC. 5. Amend section eight thousand seven hundred and seventy-nine by striking out all of said section after the word "elect," in the third line, and inserting in lieu thereof the following: "to the secretary of the State board of agriculture (wherever his office may be located), who shall cause a thorough investigation to be made by or under the direction of the State veterinarian, as the latter officer may deem best," so that said section, when amended, will read as follows:

"SEC. 8779. Such petition may be forwarded by mail or otherwise, as said petitioners may elect, to the secretary of the State board of agriculture (wherever his office may be located), who shall cause a thorough investigation to be made by or under the direction of the State veterinarian, as the latter officer may deem best."

SEC. 6. Amend section eight thousand seven hundred and eighty-one by striking out the words "or the court substituted for it under any State law," in the thirteenth line of said section, and inserting in lieu thereof the following: "or a court of criminal correction or other court with similar powers, if the cases be in a city where no county court exists;" so that said section, when amended, will read as follows:

"SEC. 8781. If, upon investigation, said veterinary surgeon shall be satisfied that said live stock is suffering from or infected or capable of infecting with or causing what is known as glanders, farcy, contagious pleuro-pneumonia, Texas fever, foot and mouth disease, rinderpest, or any other dangerous disease of a contagious, infectious, or spreading character, against which he may think best to quarantine, he shall thereupon make out in writing a notice, deliver it to the owner or person or persons in charge of said stock, setting forth the number and kind of stock so diseased, with the nature and character of the disease, with a peremptory order that said live stock shall not be moved from the locality where found or where placed by his (the veterinary surgeon's) order, until the arrival of the sheriff, and as hereinafter provided. He shall also immediately notify the county court or a court of criminal correction or other court with similar power, if the cases be in a city where no county court exists, or two judges thereof in vacation, of the county in which said diseased stock may be found, setting forth in writing the number and kind of stock affected or infected and the character and type of the disease, with the name of the person or persons in charge of said stock. Said court or two judges thereof in vacation shall thereupon issue an order in writing commanding the sheriff to at once proceed to the locality where the diseased stock may be and compel the owner or other person in whose possession such diseased stock may be found to immediately quarantine the same by placing it in pens, barns, or sheds, completely separated from any other susceptible stock not so diseased or infected, until such diseased stock shall be disinfected or completely recover, or shall have been killed or disposed of as hereinafter provided; and the pens or sheds containing the diseased stock shall be surrounded with a good and sufficient fence to prevent any other stock from approaching nearer than one hundred feet to the barn or pen containing such diseased stock, unless said veterinary surgeon is satisfied that it is impracticable to quarantine as herein set forth; then he shall prescribe in writing such other rules and regulations as he may deem best, and shall forward to the judges of the court aforesaid, or a legally substituted court thereof, a notice of the change in manner of quarantine, together with a copy of the rules substituted therefor, which substituted rules shall, by the judge aforesaid, be delivered to the sheriff for his guidance and direction in the enforcement of this law; said veterinary surgeon may, in his discretion, order owner or owners or person or persons in charge to bury or burn carcasses of dead animals, and such person thereupon shall execute such order as prescribed."

SEC. 7. Amend section eight thousand seven hundred and eighty-two by striking out the words "or a legal substitute therefor," in the fifth line of said section, and inserting in lieu thereof the words "or a court of criminal correction or other court, as specified in section eight thousand seven hundred and eighty-one;" so that said section when amended will read as follows:

"SEC. 8782. It shall be lawful for any citizen of this State who shall own animals affected with either glanders and farcy, *maladie du coït* (or horse syphilis), contagious pleuro-pneumonia, or rinderpest, and who shall have the same in quarantine under this article on account of either of said diseases, to appear before the county court, or a court of criminal correction, or other court, as specified in section eight thousand seven hundred and eighty-one, having jurisdiction in the locality in which said disease shall exist, and to present evidence why said diseased stock should be slaughtered and compensation granted, as hereinafter provided."

SEC. 8. Amend section eight thousand seven hundred and eighty-three by striking out the words "or its legal substitute," in the first line, and inserting in lieu thereof the words "or a court of criminal correction or other court mentioned in section eight thousand seven hundred and eighty-one," and by striking out the words "that in no case shall the appraised value be more than one hundred dollars for any one animal," where they occur in the twentieth and twenty-first lines of said section, and inserting in lieu thereof the following words: "that in case of glanders reported to the court by the State veterinarian as acute the appraisement shall not exceed five dollars each; that in cases of glanders reported by said veterinarian as subacute the appraisement shall not exceed twenty-five dollars for each animal; that in cases of glanders reported by the same officer as chronic the appraisement shall not exceed fifty dollars for any one case; that the appraisement of any stock for any diseases for which indemnity may be paid under this section shall not exceed fifty dollars for each animal;" so that said section, when amended, will read as follows:

"SEC. 8783. Whenever a county court or a court of criminal correction, or other court mentioned in section eight thousand seven hundred and eighty-one, in session, shall find from the evidence presented by any citizen of this State, as provided for in section eight thousand seven hundred and eighty-two of this article, that said citizen is the proprietor of any animal affected with glanders, or *maladie du coït*, or contagious pleuro-pneumonia, or rinderpest, and that said animal is in quarantine under this article, and that said animal became so diseased accidentally and not through any inhuman or gross and willful neglect or scheming on the part of said proprietor; that said diseased stock was not already diseased when it came in possession of said proprietor; that said diseased stock did not come already affected with said disease from another State or from any Territory or from any other country; that said diseased stock has not been exposed outside of Missouri three months prior to its importation in this State, to any of the said contagious or infectious diseases, it shall be the duty of the said court to appoint three disinterested parties, who shall be stock-owners, to go and appraise said diseased and quarantined stock. Said appraisers, bringing with them the sheriff, shall at once proceed to the locality where said quarantined stock shall be and there make the appraisement, taking into consideration the condition of said stock, also the disease with which it is affected, in determining its value, and immediately report the same, in writing, to the said court: *Provided,* That in cases of glanders reported to the court by the State veterinarian as acute the appraisement shall not exceed five dollars each; that in cases of glanders reported by said veterinarian as subacute the appraisement shall not exceed twenty-five dollars for each animal; that in cases of glanders reported by the same officer as chronic the appraisement shall not exceed fifty dollars for any case; that the appraisement of any stock, for any disease for which indemnity may be paid under this section, shall not exceed fifty dollars for each animal. Said sheriff shall, after appraisement, kill said stock and order the same burned or buried by the proprietor, and he shall embody a description of the same animals with the report of the appraisers to said court. Said court, upon receipt of such appraisement, shall report the same to the governor, and the governor shall indorse thereon his order to the State auditor for payment of the same; thereupon the State auditor shall issue his warrant for the same on the State treasurer. But said court shall refuse to grant appraisers any compensation when it shall be made clear to the judges thereof that said proprietor's claim is not within the limits of this section as aforeprescribed or not made within the provisions of this article."

SEC. 9. Amend section eighty-seven hundred and ninety by striking out the words "dean of the agricultural college," in the second line of said section, and inserting in lieu thereof the words "secretary of the State board of agriculture," and by striking out the words "dean of the agricultural college," in the sixth line of said section, and inserting in lieu thereof the words "secretary of the State board of agriculture;" so that said section, when amended, will read as follows:

"SEC. 8790. Said veterinary surgeon shall report to the secretary of the State board of agriculture, in writing, at least once in every three months, setting forth the locality or localities visited, as provided in the preceding sections, the kind of stock treated, the type and character of the diseases, the remedies prescribed, and the results, so far as known, of such treatment. The secretary of the State board of agriculture shall, from time to time, as often as may be required, select from said reports and publish in a concise form such information as he may think valuable to the people of Missouri. This information may be published in connection with the reports relating to agriculture or in separate bulletins."

SEC. 10. Amend section eighty-seven hundred and ninety-one by striking out the words "State veterinary surgeon," in the first line of said section, and inserting in lieu thereof the words "secretary of the State board of agriculture;" so that said section, when amended, will read as follows:

"SEC. 8791. It shall be the duty of the secretary of the State board of agriculture to collate and compile, briefly and concisely, the useful and interesting information derived from the veterinary sanitary service, as provided for in this article, and report to the general assembly within ten days of the date of the meeting thereof, together with such suggestions as may be beneficial to the agricultural interests of the State."

SEC. 11. Amend section eighty-seven hundred and ninety-three by striking out the words "board of curators," where they occur in the ninth and tenth lines of said section, and inserting in lieu thereof the words "board of agriculture," and striking out the words "help for clerical work and," in tenth line, and by inserting between the word "men" and the word "as," in the eleventh line, the words "and special experts;" so that said section, when amended, will read as follows:

"SEC. 8793. Whenever the State veterinary surgeon shall find it impossible to perform alone, in an effective manner, the duty imposed by this article, he shall appoint, as may be needed, one or more deputy State veterinary surgeons, who shall be competent veterinarians, graduated from some reputable veterinary school or college. Such deputy veterinary surgeon shall have, when on duty, the same power and same protection as now provided in this article for the State veterinary surgeon, and shall work under his direction and instructions. Such appointments shall be subject to the approval of the board of agriculture. Said State veterinary surgeon may also employ nonprofessional men and special experts as agents or inspectors whenever such a means shall become absolutely necessary to carry out this law properly, or enforce the regulations of quarantine as possible in cases of emergency provided against by sections eighty-seven hundred and eighty-five and eighty-seven hundred and eighty-six of this article."

SEC. 12. Amend section eighty-seven hundred and ninety-four by striking out all the words between the word "surgeon," in the second line, and the word "the," in the ninth line of said section, and inserting in lieu thereof the following: "shall receive for his services the sum of twenty-five hundred dollars per annum, and also his traveling and incidental expenses in the discharge of his professional duties, payable out of funds provided for the maintenance of the veterinary service, quarterly or oftener, as the board may direct;" and also amend by striking out the words "five dollars," in the tenth line of said section, and inserting in lieu thereof the words "seven dollars," and amend further by striking out the words "board of curators," where they occur in the twelfth and thirteenth lines of said section, and inserting in lieu thereof the words "board of agriculture;" and by inserting after the word "appropriation," in eighth line, the words "for the veterinary service;" also by striking out the words "board of curators," in the fourteenth line of said section, and inserting in lieu thereof the words "board of agriculture;" and by striking out the words "in connection with this article," in line nine; so that said section, when amended, will read as follows:

"SEC. 8794. The State veterinary surgeon shall receive for his services the sum of twenty-five hundred dollars per annum, and also his necessary traveling and incidental expenses in the discharge of his professional duties, payable out of the funds provided for the maintenance of the veterinary service, quarterly or oftener, as the board may direct. The deputy veterinary surgeons shall receive seven dollars per diem and traveling expenses, and incidental expenses necessary in the performance of their duties, for each and every day actually and necessarily employed under this law, payable also by said board of agriculture out of appropriation for the veterinary service. Said State veterinary surgeon shall render account to said board of agriculture for the number of miles traveled by himself, deputies, or inspectors, the help employed, and the cost thereof, and all the incidental expenses incurred in the working under this law; said account or accounts shall be audited, and if found correct shall be allowed as now provided by law."

SEC. 13. The necessity existing for the immediate operation of this act creates an emergency within the meaning of the constitution; therefore this act shall be in force and take effect from and after its passage.

Approved, March, 27, 1891.

AN ACT to prevent the spreading of contagious and infectious diseases among domestic animals, by making it unlawful for persons to haul on the public roads and highways of this State, in counties having less than one hundred thousand inhabitants, the carcasses of animals that die of disease.

Be it enacted by the general assembly of the State of Missouri as follows: That it shall be unlawful for any person or persons to engage in hauling the carcasses of swine, sheep, cattle, and horses that may die of any contagious or infectious disease, or to sell, buy, or give the same away.

SEC. 2. That the owners of such domestic animals that may die of any such contagious or infectious disease are hereby required to keep the carcasses of all such animals upon the premises of said owners, and shall in no case be permitted to sell or give such carcasses away, or remove the same, except as hereinafter provided.

SEC. 3. All owners of such domestic animals that may die of any contagious or infectious disease shall be required to dispose of the carcasses of such animals by burying, burning, or removing said carcasses to some place upon said owners' premises as remote from public roads and highways, and the stock lots, pastures, and feeding places used by adjoining land and stock owners for lotting, pasturing, and feeding domestic animals, as circumstances will permit: *Provided*, That nothing contained in this act shall be construed as interfering with the rights of any city, incorporated town or village making such disposition of the carcasses of such animals as may die or be found dead within the corporate limits of any such city, town or village, as the municipal ordinances and regulations of such cities, towns, and villages may provide.

SEC. 4. Every person who shall violate any of the provisions of this act shall be adjudged guilty of misdemeanor, and, upon conviction thereof, shall be fined not less than ten nor more than fifty dollars.

Approved, March 27, 1891.

NEW HAMPSHIRE.

AN ACT to prevent certain contagious diseases among domestic animals.

Be it enacted by the senate and house of representatives in general court convened, The mayor and aldermen of cities and the selectmen of towns, in case of the existence in this State of the disease called glanders among horses, or any other contagious or infectious disease among domestic animals, shall cause the animals in their respective cities and towns, which are infected or which have been exposed to infection, to be secured or collected in some suitable place or places within their cities or towns, and kept isolated; and when taken from the possession of their owners, one-fifth of the expense of their maintenance shall be paid by the city or town wherein the animal is kept, and four-fifths by the State; such isolation to continue so long as the existence of such disease or other circumstances may render it necessary.

SEC. 2. The mayor and aldermen and selectmen, respectively, when any such animal is adjudged by a veterinary surgeon, by them selected, to be infected with any contagious or infectious disease may, in their discretion, order such diseased animal to be forthwith killed and buried at the expense of such city or town. No payment shall be made for any horse slaughtered under this act that was not owned in the State at least three months before the disease was detected.

SEC. 3. They may cause all such animals so ordered killed to be appraised by a committee of three competent and disinterested men, under oath, at the value thereof at the time of the appraisement, and the amount of the appraisement shall be paid as provided in section one. In case the owner of the animal shall be aggrieved by the amount of such appraisement, he may by petition appeal to the trial term of the supreme court next holden in and for the county in which said city or town is located, within thirty days after said committee shall notify him of their award, and shall serve notice of such appeal upon said city or town at least fourteen days before the return day of said term.

SEC. 4. Said owner shall enter said petition in said court, and shall be entitled therein to a trial as to the value of said horse at the time of said appraisement by the court or jury, according to the laws of this State. Said owner shall not be entitled to any costs in said trial unless he shall be awarded a greater sum than the amount awarded him by said committee.

SEC. 5. A city or town whose officers neglect or refuse to carry into effect the provisions of this act shall be liable to a fine of not exceeding five hundred dollars.

SEC. 6. This act shall take effect upon its passage.

Approved, August 16, 1889.

AN ACT to constitute a State board of cattle commissioners.

Be it enacted by the senate and house of representatives in general court convened, That for the purpose of facilitating and encouraging the live-stock interests of the State of New Hampshire, and for extirpating all infectious and contagious diseases, especially tuberculosis, that now are or may be among cattle, a State board of cattle commissioners is hereby created, to consist of the secretary of the State board of agriculture, the master of the State grange, and the secretary of the State board of health, who shall be charged with the execution of the provisions of this act, whose powers and duties shall be those provided for in this act, and whose compensation shall be fixed by the governor and council. Any vacancies occurring in the board from any cause shall be filled by appointment by the governor and council. The said commissioners shall, respectively, take an oath faithfully to perform the duties of their office, and shall immediately organize as such commission by the election of one of their number as president thereof, and proceed forthwith to the discharge of the duties devolved upon them by the provisions of this act.

SEC. 2. That it shall be the duty of the said commissioners to cause investigation to be made as to the existence of tuberculosis, pleuro-pneumonia, foot-and-mouth disease, and any other infectious or contagious diseases among cattle, and such commissioners, or their duly constituted agent, are hereby authorized to enter any premises or places, including stock yards, cars, and vessels within any county or part of the State in or at which they have reason to believe there exists any such disease, and to make search, investigation, and inquiry in regard to the existence of said diseases therein. Upon the discovery of the existence of any of the said diseases the said commissioners are hereby authorized to give notice, by publication, of the existence of such disease and the locality thereof, in such newspapers as they may select, and to notify in writing the officials or agents of any railroad, steamboat, or other transportation company doing business in or through such infected locality, of the existence of such disease, and are hereby authorized and required to establish and maintain such quarantine of animals, places, premises, or localities as they may deem necessary to prevent the spread of any such disease, and also to cause a disinterested appraisal of the animal or animals affected with the said disease, in accordance with such rules and regulations by them as hereinafter authorized and provided, and also to cause the said animals to be destroyed, and to pay the owner or owners thereof one-half of their value, as determined upon the basis of health before infection, out of any moneys in the treasury not otherwise appropriated: *Provided, however,* That no appraised value shall be more than one hundred dollars for an animal killed: *And provided further,* That in no case shall compensation be allowed for an animal destroyed under the provisions of this act which may have contracted or been exposed to such disease in a foreign country or on the high seas, or that may have been brought into this State within one year previous to such animal showing evidence of such disease; nor shall compensation be allowed to any owner who in person or by agent knowingly and willfully conceals the existence of such disease or the fact of exposure thereto in animals of which the person making such concealment, by himself or agent, is in whole or in part owner.

SEC. 3. That the said commissioners are hereby authorized and required to make, record, and publish rules and regulations providing for and regulating the agencies, methods, and manner of conducting the investigations aforesaid, regarding the existence of said contagious diseases; for ascertaining, entering, and searching places where such diseased animals are supposed to exist; for ascertaining what animals are so diseased, or have been exposed to contagious diseases; for making, reporting, and recording descriptions of the said animals so diseased, exposed, or destroyed, and for appraising the same, and for making payment therefor; and to make all other needful rules and regulations which may, in the judgment of the commissioners, be deemed requisite to the full and due execution of the provisions of this act. All such rules and regulations, before they shall become operative, shall be approved by the governor and thereafter published in such manner as may be provided for in such regulations; and after such publication said rules and regulations shall have the force and effect of law, so far as the same are not inconsistent with this act and other laws of the State or the United States.

SEC. 4. That any person or persons who shall knowingly and willfully refuse permission to said commissioners, or any one of them, or their duly constituted agent, to make, or who knowingly and willfully obstructs said commissioners, or any one of them, or their duly constituted agent, in making all necessary examinations of and as to animals supposed by said commissioners to be diseased as aforesaid, or in killing the same, or who knowingly attempts to prevent said commissioners, or any one of them, or their duly constituted agents, from entering upon the premises and other places hereinbefore specified where any of said diseases are by said commissioners supposed to exist, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, or of any of the acts in this section prohibited, shall be punished by fine not exceeding one hundred dollars or by imprisonment not exceeding ninety days, or by both fine and imprisonment, at the discretion of the court.

SEC. 5. That any person who is the owner of, or who is possessed of any interest in any animal affected with any of the diseases named in section two of this act, or any person who is agent, common carrier, consignee, or otherwise is charged with any duty in regard to any animal so diseased or exposed to the contagion of such disease, or any officer or agent charged with any duties under the provisions of this act, who shall knowingly conceal the existence of such contagious disease or the fact of such exposure to said contagion, or who shall knowingly and willfully fail, within a reasonable time, to report to the said commissioners their knowledge or their information in regard to the existence and location of said disease, or of such exposure thereto, shall be deemed guilty of a misdemeanor, and shall be punishable as provided in section four of this act.

SEC. 6. That when the owner of animals, decided under the provisions of this act, by the proper authority, to be diseased, or to have been exposed to contagion, refuses to accept the sum authorized to be paid under the appraisement provided for in this act, it shall be the duty of the commissioners to declare and maintain a rigid quarantine as to the animals decided as aforesaid to be diseased or to have been exposed to any contagious or infectious disease, and of the premises or places where said cattle may be found, according to the rules and regulations to be prescribed by said commissioners, approved by the governor, and published as provided in the third section of this act.

SEC. 7. That no person or persons owning or operating any railroad, nor the owner or owners or masters of any steam, sailing, or other vessels, within the State, shall receive for transportation or transport from one part of the State to another part of the State, or to bring from any other State or foreign country any animals affected with any of the diseases named in section two of this act, or that have been exposed to such diseases, especially the disease known as tuberculosis, knowing such animals to be affected or to have been exposed thereto; nor shall any person or persons, company or corporation, deliver for such transportation to any railroad company, or to the master or owner of any vessel, any animals, knowing them to be affected with or to have been exposed to any of said diseases; nor shall any person or persons, company or corporation, drive on foot, or transport in private conveyance from one part of the State to another part of the State, any animal, knowing the same to be affected with or to have been exposed to any of said diseases. Any person or persons violating the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by fine not exceeding the sum of two hundred dollars, or by imprisonment not exceeding six months, or by both fine and imprisonment.

SEC. 8. That it shall be the duty of the several county solicitors to prosecute all violations of this act which shall be brought to their notice or knowledge by any person making the complaint under oath; and the same shall be heard in the supreme court.

SEC. 9. That the said commissioners are hereby authorized to appoint or elect one of their number as secretary of said board, who shall receive a reasonable compensation for his services during the time in which, under the provisions of this act, the services of the said commissioners shall be required. The said commissioners shall make and preserve a full record of all rules and regulations promulgated under the provisions of this act, of all payments and expenses hereunder incurred, and all other transactions performed by said commissioners in the discharge of their duties as herein provided; and the said commissioners shall, on or before the first Wednesday in January of each year, during their continuance in service, and at other times as they may deem conducive to the public interests or as they may be required to do by the governor of the State, report to said governor full and accurate accounts of their expenditures and other proceedings under the provisions of this act, and of the condition of said diseases, if any, in the state, to be communicated by him to the legislature. Whenever the functions of said commission shall be suspended or terminated, it shall turn over to the secretary of State all its books, papers, records, and other effects, taking his receipt therefor, and he shall remain the custodian of the same until such time as the functions of said commission may be restored.

SEC. 10. That the commissioners shall have power and are hereby authorized to employ skilled veterinarians, and such other agents and employés as they may deem necessary to carry into effect the provisions of this act, and to fix the compensation of the person or persons so employed, and to terminate such employment at their discretion; and they are authorized to make such expenditures as may be needed for the actual and necessary traveling expenses of themselves and their said employés, stationery, expenses of disinfecting premises, cars, and other places, destroying diseased and exposed animals and paying for the same, and such other expenses and expenditures as they may find to be actually necessary to carry into effect properly the provisions of this act.

SEC. 11. That at any time, should it become an actual necessity to declare a quarantine against any or all animals entering within the borders of the State, for the public health and safety, it shall be the duty of said commission to confer with the governor and council, and they may adopt measures to prevent the spread of infectious and contagious diseases in the State, to remain in force until the safety of the State and the approval of the commission and the governor and council allow the repeal of said measures of quarantine.

SEC. 12. That all bills and expenses incurred under the provisions of this act shall be approved by the commission and audited by the governer and council, and the expenditures shall not exceed ten thousand dollars in any one year, to be paid from the State treasury, on the order of the governor, out of any moneys not otherwise appropriated.

SEC. 13. That chapter ninety-three, laws of eighteen hundred and eighty-nine, and all other acts and parts of acts inconsistent with this act, are hereby repealed.

Approved, April 7, 1891.

NEW YORK.

AN ACT to provide for the destruction of animals affected with the disease known as glanders. Approved by the governor March 14, 1888.

The people of the State of New York, represented in senate and assembly, do enact as follows: It shall be the duty of the local boards of health in this State to destroy, or cause to be destroyed, all animals found within their jurisdiction affected with the disease called glanders. The proceedings of said boards of health under this act shall be controlled and directed by such rules and regulations as the State board of health shall from time to time prescribe.

SEC. 2. This act shall take effect immediately.

[Rules and regulations in pursuance of the above act.]

Whereas by chapter fifty-three of the laws of eighteen hundred and eighty-eight, local boards of health in this State are required to destroy animals found with the glanders within their jurisdiction, and the proceedings of said local boards in reference thereto are to be controlled and directed by such rules and regulations as the State board of health shall prescribe;

Now, therefore, the said State board of health, by virtue of the power vested in it, has prescribed the following rules and regulations to be observed by said local boards of health in carrying out the provisions of said chapter fifty-three of the laws of eighteen hundred and eighty-eight, to wit:

1. A local board of health being notified of the existence of said disease, glanders, must take proper means to determine the nature of the disease by employing a competent veterinary surgeon or other person or persons who in their judgment are competent to pronounce upon the nature of the suspected disease.

2. Upon the written certification of said veterinary or other person or persons thus employed, said local board of health shall kill, or cause to be killed, any animal or animals having the glanders, and shall cause the carcasses of all animals so killed to be disinfected and buried forthwith, at least three feet below the surface of the ground, and shall further cause all stalls, stables, barns, sheds, halters, harnesses, blankets, buckets, measures, mangers, racks, or other places or utensils which may have been exposed to the contagion of said disease, to be thoroughly disinfected and cleaned.

3. Local boards of health are hereby cautioned against too hasty judgment, and advised to use every precaution to insure a correct determination as to the nature of the disease. A record of all proceedings should be placed in writing and filed in the office of the board of health.

4. Local boards must report all action taken under chapter fifty-three, laws of eighteen hundred and eighty-eight, to the State board of health.

By order of the board.

LEWIS BALCH, M. D.,
Secretary and Executive Officer.

ALBANY, N. Y., *May 29, 1888.*

AN ACT in relation to tuberculosis in milch cows and other cattle, and infectious and contagious diseases of cattle.

The people of the State of New York, represented in senate and assembly, do enact as follows: That the State board of health shall use all reasonable means for ascertaining the existence and cause of disease in or danger to health from milch cows and other cattle in the State of New York, and for averting the same and preventing all injury from tuberculosis in milch cows or other cattle in any part of the State, and shall promptly cause all proper information in possession of said board of health respecting any such disease among cattle in any part of the State to be sent to the local board of health of the city, village, or town nearest to the herd, cows or other cattle, affected by any such disease, and shall add thereto such useful suggestions as to the removal of all sources of danger therefrom or the destruction of said cattle as the experience of the said board may at any time supply. And it is made the duty of the health authorities throughout the State to supply the like information and suggestions to the State board of health respecting the existence of any infectious or contagious disease in milch cows or other cattle in any part of the State.

SEC. 2. The State board of health shall have power to employ such and so many medical and veterinary practitioners and other persons as it may from time to time deem necessary to assist in the inspection, in the isolation, destruction, or disposition of milch cows or other cattle affected with tuberculosis or any infectious or contagious disease in any portion of the State, to prescribe rules and regulations for such inspectors and employés and to fix their compensation.

SEC. 3. Whenever tuberculosis shall be found among milch cows or other cattle in any part of the State it shall be the duty of the State board of health to take measures to suppress said disease promptly, to prevent the same from spreading, and the said State board of health shall have authority to order all persons to take such precautions against the spread of such disease as, in the judgment of the said State board of health, may be necessary or expedient; and, further, to call upon all sheriffs, deputy sheriffs, and officers of the peace in the neighborhood where such disease extends among milch cows or other cattle to carry out and enforce the orders of said board of health respecting the same, and to observe and carry out the rules and orders and instructions which they may receive from the said board of health in the premises; and, further, to prescribe regulations for the destruction of animals affected with tuberculosis or any contagious or infectious disease, and for the proper disposition of their hides and carcasses, and of all objects which might convey infection or contagion: *Provided*, That no animal shall be destroyed unless first examined by a medical or veterinary practitioner in the employ of the State board of health aforesaid; and, further, to prescribe rules and regulations for the disinfection of premises, buildings, boats, railroad cars, stables, and all objects from or by which infection or contagion may take place or be conveyed, and to alter or modify from time to time all such rules, regulations, orders, and instructions as the said State board of health may deem expedient.

SEC. 4. Whenever, in the judgment of the said State board of health, it may become necessary to prevent the spread of tuberculosis or any infectious or contagious disease of domestic animals, or the public welfare shall be promoted thereby, the said board of health may cause to be slaughtered, and has authority to kill, or order to be killed, any animal or animals which, by contact or cohabitation with diseased animals, or by exposure to infection or contagion therefrom, the said State board of health may consider and determine may be liable to contract or communicate the disease sought to be suppressed, and to prevent all danger therefrom.

SEC. 5. Any person or persons refusing to obey the orders, rules, or regulations of the said board of health adopted in pursuance to the provisions of this act and the authority by this act given to the said State board of health, or transgressing the rules, orders, and regulations of the said State board of health adopted for the removal of the sources of danger from tuberculosis in milch cows or other cattle, or any infectious or contagious disease in domestic animals in any part of the State, shall be guilty of a misdemeanor, and shall also be liable to pay a fine of one hundred dollars, which fine the State board of health is hereby authorized to sue for and collect in its name in any court of this State.

SEC. 6. All expenses incurred by the State board of health in carrying out the provisions of this act and in performing the duties hereby devolved upon it shall be audited by the comptroller as other expenses of the said State board of health, and the sum of five thousand dollars, or so much thereof as may be necessary, is herewith appropriated out of any money in the treasury not otherwise appropriated, for carrying out the provisions of this act.

SEC. 7. The actual value at the time they are killed of any animals slaughtered under the provisions of this law, to be ascertained and determined as hereinafter provided, may be paid to the owners of such cattle under and pursuant to any resolution of the said State board of health providing for such payment, and the board of claims shall have exclusive jurisdiction to hear, audit, and determine all claims which shall arise under the provisions of this act and to allow thereon such sums as should be paid by the State: *Provided, however*, That no compensation shall be made under the provisions of this act or otherwise to any person who shall willfully have concealed the existence of disease among his animals or upon his premises, or who shall in any way, directly or indirectly, by act or by willful neglect, have contributed to the spread of disease sought to be suppressed or prevented: *And provided further*, That such claims shall not have accrued more than two years prior to the filing of the said claims.

SEC. 8. This act shall take effect immediately.

Approved by the governor May 5, 1892.

NORTH CAROLINA.

AN ACT to prevent the spread of cattle distemper.

The general assembly of North Carolina do enact:

SECTION 1. That it shall be unlawful for any person or persons to drive oxen or other cattle from any portion of Henderson County where cattle are infected with distemper, where such cattle have remained in said distempered region for ten days' time, to any point in Transylvania County, during the months of July, August, September, October, and November.

SEC. 2. That any person violating this act shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not less than five dollars nor more than fifty dollars.

SEC. 3. That this act shall be in force from and after the first day of July, eighteen hundred and ninety-one.

Ratified the 27th day of February, A. D. 1891.

OHIO.

AN ACT to prevent the spread of glanders or farcy among horses, and foot rot and scab among sheep.

Be it enacted by the general assembly of the State of Ohio, That any person owning, or having in his charge, any horse, mule, or ass that he knows, or has reason to believe, is affected with the disease known as glanders or farcy, or that has been adjudged to be so affected, by the State board of live-stock commissioners, upon a report made to said board by a competent veterinary surgeon in their employ, after a careful examination of such animal, who shall sell or otherwise dispose of or secrete the same, or shall fail to keep such animal securely isolated, so that contact with other horses, mules or asses shall not be possible, shall, upon conviction of either of said offenses, be fined in any sum not exceeding five hundred dollars; and shall, moreover, be liable for all damages sustained by reason of the same.

SEC. 2. In case the live-stock commissioners shall order the destruction of any animal affected with glanders or farcy in the chronic stage of the disease, which may be adjudged capable of rendering some service, the board may cause the animal to be appraised, and order such compensation to be paid out, on the order of the live-stock commissioners, on the warrants of the auditor of State, out of any funds in the treasury to the credit of the live-stock commissioners, as in the judgment of the commissioners may be just, not exceeding its cash value: *Provided*, The horse was not diseased when passed in possession of the owner.

SEC. 3. Any person owning or having in charge any sheep affected with foot rot or scab, who shall drive or suffer the same to run upon any highway, common, or other uninclosed ground, or shall sell such sheep, knowing or having reason to believe them to be diseased, without disclosing the fact to the purchaser, shall, upon conviction of either of said offenses, be fined in any sum not exceeding one hundred dollars, and be liable to parties injured for all damages sustained.

SEC. 4. This act shall take effect and be in force from and after its passage.

Passed April 16, 1888.

A BILL to supplement section sixty-nine hundred and twenty-three of the Revised Statutes.

Be it enacted by the general assembly of the State of Ohio, That the following section be enacted supplementary to section sixty-nine hundred and twenty-three of the Revised Statutes of the State of Ohio, with sectional numbering as follows:

"SEC. 6923a. The bodies of all animals dying from contagious diseases shall be burned, or buried at least four feet below the surface of the ground, by the owner thereof. Any such owner permitting such dead animals to remain unburned or unburied, or neglecting or refusing to comply with the provisions of this section within twenty-four hours after having knowledge of the existence of such dead animals, or after notice thereof in writing from the trustees of the township in which such dead animals may be found, it shall be the duty of said trustees to proceed to dispose of such dead animals as provided in this section, and such owner so neglecting or refusing, shall be fined in any sum not less than five dollars nor more than twenty dollars, together with the cost of suit and all necessary expenses incurred by said trustees in disposing of such animals.

"Action to recover fines, costs, and expenses as herein provided shall be brought upon complaint of said trustees before any justice of the peace in the township in which such owner resides: *Provided*, That the dead bodies of such animals may be removed to a fertilizing establishment, if removed in a water-tight tank."

SEC. 2. This act shall take effect on its passage.

In House, passed February 10, 1891.
In Senate, passed March 11, 1891.

A BILL to amend sections seventy-four hundred and sixty-eight, thirty-seven, and seventy-four hundred and sixty-eight, forty, of the Revised Statutes of Ohio.

Be it enacted by the general assembly of the State of Ohio, That sections seventy-four hundred and sixty-eight, thirty-seven, and seventy-four hundred and sixty-eight, forty, of the Revised Statutes be amended to read as follows:

"SECTION 7468-37. Any railroad or other transportation company conveying *into or* through this State, *or any stock-yard company receiving such cattle* during the months aforesaid will not be permitted to unload the same in the State for any other purpose than to be fed and watered, *or for immediate slaughter*, and in yards and premises especially provided for that purpose, into which northern cattle will not be permitted to enter. *And the location and arrangement of the said yards and premises and the disinfection of the cars and quarters used in the transportation of such cattle shall be governed by the rules and regulations prescribed by the board of live-stock commissioners.*

"SEC. 7468-40. *Upon the request of the board of live-stock commissioners it shall be the duty of the prosecuting attorney of any county in which the suit may be brought to begin and prosecute any action for the violation of the provisions of this act and the rules and regulations of the board of live-stock commissioners.* Proceedings against any railway company under this act may be had in any county in this State through which any portion of such company's road may pass, or in which its principal office may be situated; and process may be served by leaving a copy at the office of such company within such county."

SEC. 2. That sections seventy-four hundred and sixty-eight, thirty-seven, and seventy-four hundred and sixty-eight, forty, be, and the same are hereby, repealed; and this act shall take effect and be in force from and after its passage.

Passed April 25, 1891.

OREGON.

AN ACT to amend sections three, four, five, six, and seventeen of an act entitled "An act to prevent the spread of contagious animal diseases," passed at the session of eighteen hundred and eighty-nine and approved February twenty-five, eighteen hundred and eighty-nine.

Be it enacted by the legislative assembly of the State of Oregon: That section three of an act entitled an act to prevent the spread of contagious animal diseases, approved twenty-five, eighteen hundred and eighty-nine, be amended so as to read as follows:

"SEC. 3. The salary of the State veterinarian shall be fixed by the commission, and shall not exceed fifteen hundred dollars a year and his necessary traveling expenses, and the salaries of the commissioners shall be two hundred and fifty dollars each per annum."

SEC. 2. That section 4 of an act entitled an act to prevent the spread of contagious animal diseases, passed at the session of eighteen hundred and eighty-nine and approved February twenty-five, eighteen hundred and eighty-nine, be amended so as to read as follows:

"SEC. 4. It shall be the duty of the commission to protect the health of the domestic animals of the State from all contagious or infectious diseases of a malignant character, and for this purpose it is hereby authorized and empowered to employ local inspectors in localities where the commission deem it essential for the protection of domestic animals from contagious diseases, and to establish, maintain, and enforce such quarantine, sanitary, and other regulations as it may deem necessary."

SEC. 3. That section five of an act entitled "An act to prevent the spread of contagious animal diseases," passed at the session of eighteen hundred and eighty-nine and approved February twenty-five, eighteen hundred and eighty-nine, be amended so as to read as follows:

"SEC. 5. It shall be the duty of the stock-inspector of each county, and of each local inspector, who discovers, suspects, or has reason to believe that any domestic animal or animals in his county or locality is affected with any dangerous contagious disease to immediately report such fact to the State veterinarian."

SEC. 4. That section six of an act entitled "An act to prevent the spread of contagious animal diseases," approved February twenty-five, eighteen hundred and eighty-nine, be amended so as to read as follows:

"SEC. 6. It shall be the duty of said State veterinarian, upon the receipt of such information from a stock-inspector of any county that any contagious or infectious disease does exist, to immediately examine or deputize a competent person to examine all animals reported to be diseased, and if he finds that such animals are infected with a contagious or infectious disease he shall promptly take such measures as he may deem expedient and necessary to prevent the spread of the disease; he shall also immediately notify the commission of his actions, which shall be subject to the approval of the commission, who shall subsequently instruct him how to proceed and prescribe such rules and regulations as in their judgment the exigencies of the case may require for the effectual suppression and eradication of the disease, and for that purpose the State veterinarian may list and describe the domestic animals affected with such disease, and those which have been exposed thereto, and included within the infected district or premises so defined and quarantined with such reasonable certainty as would lead to their identification; and no domestic animal liable to become infected with the disease or capable of communicating the same shall be permitted to enter or leave the district, premises, or ground quarantined, except by authority of the commission. When, in the opinion of the commission, it shall be necessary, to prevent the spread of contagious or infectious disease among the live stock of the State, to destroy animals affected with or which have been exposed to any such disease, it shall determine what animals shall be killed, and appraise the same, as hereinafter provided, and cause the same to be killed and the carcasses disposed of, as in their judgment will best protect the health of domestic animals of the localities."

SEC. 5. That section seventeen of an act entitled "An act to prevent the spread of contagious animal diseases," approved February twenty-five, eighteen hundred and eighty-nine, be amended so as to read as follows:

"SEC. 17. The commission shall have power to call upon any sheriff, undersheriff, deputy sheriff, constable, or stock-inspector of any county to execute their orders, and such officers shall obey the orders of said commission, and the officers performing such duties shall receive compensation therefor as is prescribed by law for like services, and shall be paid therefor in like manner, and any officer may arrest and take before any justice of the peace of the county any person found violating any of the provisions of this act, and such officer shall immediately notify the prosecuting attorney of such arrest, and he shall prosecute the person so offending, according to law."

SEC. 6. Inasmuch as the labor required of the commissioners and the State veterinarian is in excess of the compensation now allowed, this act shall take effect and be in force from and after its passage.

Filed in the office of the secretary of State February twenty-one, eighteen hundred and ninety-one.

RHODE ISLAND.

AN ACT for the suppression of tuberculosis among cattle.

It is enacted by the general assembly as follows: The State board of agriculture shall cause an examination to be made of any herd of cattle, or of any single animal in the State, whenever it shall appear that there is reason to suspect that such herd or animal is affected with tuberculosis, and upon confirmation of such suspicion shall direct the disposal of the affected animal or animals according to their best discretion.

SEC. 2. Whenever the examination directed by the State board of agriculture shall fail to discover conclusive evidence of the existence of tuberculosis in the suspected animal or animals, the professor of veterinary science at the Rhode Island State agricultural school and experiment station at Kingston shall examine such animal or animals, and his examination and opinion shall be final thereon.

SEC. 3. Whenever it may be deemed expedient to slaughter any animal or animals having tuberculosis, the value of such animal or animals, if killed on the written order of the said board, shall be appraised by three disinterested persons appointed by said board immediately before such animal or animals are slaughtered, and such appraised value shall be paid to the owner upon a bill approved by the governor, and the State auditor is hereby authorized to draw his order on the general treasurer for the amount approved, the same to be paid to the owner out of any money in the treasury not otherwise appropriated: *Provided,* That not more than $40 shall be paid for any single native animal, nor more than $75 for any single grade animal, nor more than $100 for any single registered animal; and, further, that when any owner shall be shown to have knowingly brought any animal suffering, or suspected to be suffering, from tuberculosis into his herd, or has concealed the existence of that disease in his herd, nothing shall be paid to such owner for animals slaughtered under this act.

SEC. 4. Whenever the board or the veterinarian employed under this act shall deem it expedient to quarantine any animal or animals, one-third of the expense of such quarantine shall be paid by the State, as provided in section 3.

SEC. 5. The veterinarian named in this act shall be paid a sum equal to that expended for his actual traveling expenses and no more, such sum to be paid on affidavit of such veterinarian, and in the manner provided in section 3.

Passed July 31, 1891.

AN ACT in amendment of chapter five hundred and seven, chapter six hundred and twenty-seven, chapter six hundred and forty-three, and chapter ten hundred and twenty-five of the Public Laws.

It is enacted by the general assembly as follows: The Rhode Island State board of agriculture shall be constituted as follows: The governor, lieutenant-governor, and secretary of state shall be *ex-officio* members of said board; one member shall be appointed from and by the board of managers of the state agricultural school; one member shall be appointed from and by each of the agricultural societies which receive an annual bounty from the State; and three members shall be appointed by the governor, one from each county not represented by an agricultural society as above, and one resident in Providence County; one member shall be appointed from and by the Rhode Island State Grange, Patrons of Husbandry.

SEC. 2. The term of office of the appointed members under this act shall be two years from the first Wednesday in March of the year of such appointment: *Provided, however,* That two of the members first appointed by the governor and the member first appointed by the board of managers of the agricultural school shall be appointed for the term of one year. All vacancies that may occur in the board by death, resignation, or otherwise, shall be filled for the unexpired term in the same manner as herein provided for the original appointment: *Provided,* That the present members of the State board of agriculture, as organized under chapters 507 and 850 of the Public Laws, shall continue in office until the end of the term for which each member was appointed.

SEC. 3. The board shall meet at least twice in each year at the statehouse in Providence, and may meet at such other times and places as may be deemed expedient. It shall be the duty of the board to look after the agricultural interests of the State, the promotion of agricultural education, and the general interests of husbandry throughout the State. The board may cause to be analyzed samples of such commercial fertilizers as may from time to time be offered for sale in this State, and may collect and distribute such seeds, plants, shrubs, and trees as may be in their power to procure from all sources. They may also take, hold in trust, and exercise control over donations or bequests for promoting agricultural education for the general interests of agriculture.

SEC. 4. The board shall hold one agricultural institute in each county annually either independently or in connection with any society, association, or other organization devoted to the same general objects, and may hold as many more as it shall deem expedient, and shall, as far as may be practicable, encourage State and local associations and societies in the interests of agriculture.

SEC. 5. The board may appoint and prescribe the duties of a secretary, who shall receive for his services, out of the appropriation for the use of the board, such sum as the board may direct, and also his necessary expenses while traveling by direction of the board. No member of the board shall receive any compensation for his services as such, but shall be entitled to receive such expenses as are necessarily incurred in the legitimate discharge of his duties.

SEC. 6. Every agricultural and kindred society receiving a bounty from the State shall make an annual return to the State board of agriculture during the month of December in each year on such matters and in such form as shall be prescribed by said board; and any society neglecting to comply with the requirements of the board shall not be entitled to the allowance from the State, as by law now provided, for the ensuing year.

SEC. 7. The board shall report annually to the general assembly at its January session. Two thousand copies of its report shall be printed by the state printers under contract to the State. The board shall distribute one copy of the report to each member of the general assembly, one to the town clerk of each town in the State for the use of the town, one to each public library, and a proper number to the agricultural school and experiment station, agricultural societies, farmers' clubs, and granges in the State, and shall make such exchanges with other like organizations as may be deemed expedient. The board may cause to be printed and distributed from time to time, in pamphlet form, such analyses of commercial fertilizers, and such other information, as the interests of agriculture may require.

SEC. 8. The board may appoint one cattle commissioner in each county of the State, whose duty it shall be to visit and inquire into the condition of any domestic animal in their respective counties whenever there is reason to suspect that any such animal is affected with tuberculosis, or other contagious, infectious, or communicable disease.

SEC. 9. The board may employ veterinary surgeons.

SEC. 10. Whenever any animal shall be suspected by either of the cattle commissioners to be affected with tuberculosis, the commissioner of the county where the animal is found shall immediately notify the secretary of the State board of agriculture, who shall promptly fix a day when the appraisers, duly appointed as hereinafter provided, shall visit the suspected animal with the veterinary surgeon; and upon confirmation of the disease, and after appraisement of the value as hereinafter provided, the affected animal shall be killed, and the carcass disposed of in such a manner as will not be detrimental to the public health.

SEC. 11. For the purposes aforesaid the board may appoint some suitable person as appraiser, whose duty it shall be to act with one of the cattle commissioners in each county, which two persons shall constitute the board of appraisers for the county. In case of disagreement between the two appraisers, the veterinary surgeon shall act as a third appraiser, and the estimate of value of either two of them shall be final, provided that not more than fifty dollars shall be allowed for any single native animal, nor more than seventy-five dollars for any single grade animal, nor more than one hundred dollars for any single registered animal. And written notice of the amount of the appraisal signed by the board of appraisers shall be immediately given to the owner or claimant of said animal, and provided further that any party aggrieved by any award made under the provisions of this section may appeal therefrom to said board within five days after the receipt of said notice.

SEC. 12. The board of appraisers, by and with the advice of the veterinary surgeon, is hereby authorized to quarantine any animal or animals supposed to be affected with a contagious, infectious, or communicable disease, and one-third of the cost of such quarantining shall be assumed and paid by the State, except as otherwise provided in section twenty-one of this act.

SEC. 13. The State shall pay to the owner of any animal killed under the provisions of section ten of this act, one-half of its appraised value; but if upon a post-mortem examination it shall be found that the slaughtered animal was not affected with tuberculosis, then the animal so killed shall be paid for at its full appraised value; provided, that the State shall not pay for any diseased animal so killed if the animal has not been in the possession of its present owner three months previous to the day of the slaughter.

SEC. 14. When any person shall be shown to have knowingly brought into this State an animal suffering, or suspected to be suffering, with tuberculosis, or to have concealed the existence of such disease in any animal owned by him, such person shall not be entitled to any compensation for the animal slaughtered under this act, and shall be deemed guilty of a misdemeanor, and upon conviction shall be fined for such offense not exceeding one hundred dollars.

SEC. 15. All persons having knowledge or reasons to suspect that any neat cattle or bovine animal has the contagious pleuro-pneumonia, or Texas cattle fever, or that any horse has glanders or farcy, or that any bovine animal or horse has any other highly contagious, infectious, or communicable disease dangerous to public health, shall make report concerning the same by mail or otherwise to the secretary of the State board of agriculture immediately giving the name of the owner or custodian of the said animal or animals and the place of keeping of the same.

SEC. 16. No person having the care or custody of any animal having any one of the diseases mentioned in the preceding sections, shall, knowing the same to have any such disease, sell or exchange, or permit the removal, use or driving of the same upon any public highway, or the exposure of the same to contact with any other healthy animal of the same kind, except by permission of some member or agent of the State board of agriculture. Any person so doing shall be deemed guilty of a misdemeanor, and on being convicted shall be fined not exceeding one hundred dollars.

SEC. 17. The State board of agriculture, or its duly authorized representatives, having reason to suspect the existence of any of the diseases mentioned in this act upon any grounds or premises, are hereby authorized and empowered to enter upon such grounds or premises for the enforcement of the provisions of this act.

SEC. 18. The governor is hereby authorized to accept, on behalf of the State, the rules and regulations prepared by the Commissioner of Agriculture under and in pursuance of section 3 of an act of Congress approved May 29, 1884, entitled, "An act for the establishment of a bureau of animal industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to coöperate with the authorities of the United States in [enforcing] the provisions of said act.

SEC. 19. The inspectors of the Bureau of Animal Industry of the United States, in coöperation with the State board of agriculture, shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious, infectious, or communicable disease, or suspected to be so affected, or that have been exposed to any such disease, and for these purposes are hereby authorized and empowered to enter upon any ground or premises. Said inspectors, in coöperation with the State board of agriculture, shall have the power to call on sheriffs, constables, and peace officers to assist them in the discharge of their duties in carrying out the provisions of the act of Congress approved May 29, 1884, establishing the Bureau of Animal Industry; and it is hereby made the duty of sheriffs, constables, and peace officers, to assist said inspectors when so requested; and said inspectors shall have the same power and protection as peace officers while engaged in the discharge of their duties.

SEC. 20. The State shall not be liable for any damages or expenses incurred under sections eighteen and nineteen of this act.

SEC. 21. Any person or persons who shall wilfully or intentionally interfere with any officer or officers, duly authorized to carry out the provisions of this act, or who shall wilfully or intentionally violate the provisions of the quarantine authorized by section thirteen of this act, shall be deemed guilty of a misdemeanor, and upon conviction shall be liable to imprisonment not exceeding three months or a fine not exceeding one hundred dollars, or both, at the discretion of the court.

SEC. 22. The State board of agriculture is hereby authorized to fix the compensation of the cattle commissioners, appraisers and veterinary surgeons, to prescribe their duties and to remove them when deemed expedient so to do.

SEC. 23. The secretary of the State board of agriculture shall make a monthly report to the governor of the obligations of the State board of agriculture; and the State auditor is hereby directed to draw his orders on the general treasurer for the payment of the same upon vouchers approved by the governor.

SEC. 24. The sum of fifteen thousand dollars, or so much thereof as may be authorized, is hereby annually appropriated for the purpose of carrying out the several provisions of this act, including all salaries and expenses created undet the authority hereof.

SEC. 25. All prosecutions for offenses against the provisions of this chapter shall be commenced within sixty days after the same shall have been committed and not afterwards.

SEC. 26. Chapter five hundred and seven, chapter six hundred and twenty-seven, chapter six hundred and forty-three, and chapter one thousand and twenty-five of the Public Laws, and all acts and parts of acts inconsistent herewith, are hereby repealed and this act shall take effect immediately upon its passage.

Passed May 19, 1892.

TENNESSEE.

AN ACT to prevent the spread of contagious diseases among animals.

SECTION 1. *Be it enacted by the general Assembly of the State of Tennessee,* That all hogs or other animals having died of contagious diseases, the owners of said dead animals be and the same are hereby compelled to either burn up or bury said dead animals.

SEC. 2. *Be it further enacted,* That any person violating the first section of this act shall be guilty of a misdemeanor, and upon conviction, fined ten dollars.

SEC. 3. *Be it further enacted,* That this act take effect from and after its passage, the public welfare requiring it.

Approved, April 8, 1889.

TEXAS.

AN ACT for the protection of the wool-growing interests of the State of Texas.

Be it enacted by the legislature of the State of Texas, That whenever it appears from the assessor's rolls that there are as many as five hundred sheep owned and assessed for taxes in any county of this State, it shall be the duty of the commissioners' court of said county upon the application of one or more resident owners of sheep of said county, to appoint an inspector of sheep, who shall be a resident citizen of the county, and well versed in the scab and other diseases which usually affect sheep, and said inspector shall hold his office for two years, or until his successor is qualified. Said inspector may appoint one or more deputies who shall take the oath of office prescribed by the constitution, and may lawfully perform the same acts as the inspector of sheep, who may require of his deputies bonds for the faithful performance of duty.

SEC. 2. Said inspector of sheep shall, within twenty days after receiving notice of said appointment, and before entering upon the duties of his office, execute a bond with two or more good and sufficient sureties, in a sum to be fixed by the commissioners' court, not less than one thousand, nor more than five thousand dollars, payable to the county judge and his successors in office, conditioned that he will faithfully and impartially discharge and perform all the duties incumbent upon him as inspector of sheep. Said bond shall be approved by the commissioners' court and recorded in the office of the county clerk of said county.

SEC. 3. It shall be the duty of the inspector of sheep or his deputy to carefully and minutely examine and inspect, at any time, sheep in his county or which may be driven into or through his county, and which he has reason to believe or is informed in writing by one or more sheep-owners of the county, is affected with scab or any other infectious or contagious disease.

SEC. 4. The inspector shall be entitled to receive the sum of two cents per head, unless otherwise provided in this act, for all sheep inspected under the provisions of this act, provided the inspector shall be entitled to only one cent per head for any number he may inspect for any one person in excess of two thousand head; in no one case shall his fees exceed fifty dollars. Such fees to be paid by the owner or person in charge of the sheep inspected: *Provided,* That when an inspector shall inspect any sheep and find no scab to exist in the flock of sheep so inspected, then the fees for such services shall be paid by the party at whose instance such services were performed: And *provided further,* That the inspector shall have a lien for his fee upon all sheep inspected by him and found to be diseased with scab: *Also, provided,* That if any owner or person in charge of sheep affected with scab, reports in writing to the county inspector or his deputy that his sheep are so affected and that he proposes to take means forthwith to cure the same, it shall not be lawful for the inspector to inspect such flock or receive any fees for the same within twenty days after said report, provided the inspector in such cases shall prescribe limits for said flock. *Provided,* That if after the expiration of the twenty days aforesaid the inspector has received no notice in writing, as hereinafter provided, from the party in charge of said flock, that he has thoroughly dipped his flock to cure the same as proposed, then the inspector shall be entitled to receive from such parties in charge of such sheep the same fee as though he had inspected said flock and found the same diseased: *Provided further,* That no person shall be required to dip his ewe sheep, if pregnant with lamb, at any time within twenty days before or after lambing, but such person shall, nevertheless, be required to hold such sheep within the portion of country prescribed by the county inspector for such sheep to be held in during the time they are so affected with scab.

SEC. 5. Whenever any flock of sheep, in any county of this State, has been inspected and found to be afflicted with scab, it shall be the duty of the owner or person in charge of such flock to thoroughly dip the same within twenty days from such inspection, and report such fact in writing to the inspector; and if no such report be made by the said owner, or person in charge of said flock, then it shall be the duty of the inspector to again inspect said flock, and may receive his fees as hereinbefore provided.

SEC. 6. It shall be the duty of the inspector or his deputy, after the expiration of ninety days from the date of notification in writing, that any flock that is diseased, as provided in section four, or from date of inspection of any diseased flock, or at any time they have reason to suspect said flock is afflicted with scab, to again carefully and minutely examine and inspect such flock or flocks, and if scab is still found to exist in said sheep, then the owner or person in charge of such sheep shall be required to again dip such sheep, as is required in the preceding section of this act.

SEC. 7. Whenever by examination, inspection, or otherwise, scab is found to exist in any flock of sheep in any county, the inspector shall at once notify the owner or person in charge thereof, of said fact, and shall prescribe certain limits within which said flock shall be herded until cured: *Provided*, No person shall be so limited as to prevent him from herding or keeping his sheep on his own lands or lands lawfully controlled by him, if the tracts of said land be so contiguous to each other, that in herding or driving the sheep, that the same will not go or be upon any tract or tracts of land of some other person: *Also, provided*, That the liberty given any person to hold diseased sheep anywhere upon lands lawfully controlled by him, shall not in any way be construed to exempt him from the provisions of sections five and six of this act.

SEC. 8. It shall be the duty of any owner or person in charge of sheep in which scab is found to exist to immediately notify all persons in charge of sheep in vicinity of said flock. And until he shall have obtained a certificate from the inspector of his county that his flock is cured he shall not remove the same from the limits prescribed by said inspector.

SEC. 9. Any sheep being driven into or through any county in this State shall be accompanied by a certificate from some inspector to the effect that such sheep are free from scab; it shall state the date of inspection, and shall not be older than sixty days, and any person through whose range such sheep are being driven or about to be driven, shall have the right to see said certificate upon request, and upon refusal to produce the same upon request, the party so refusing shall be guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not exceeding one hundred dollars: *Provided, however*, That said certificate shall not exempt said sheep from inspection at any time.

SEC. 10. For inspections made under the provisions of the preceding section the inspector shall be entitled to receive the sum of one cent for each head of sheep covered by the certificate.

SEC. 11. Any sheep brought into Texas by rail or other means of transportation shall be disinfected by dipping or otherwise before being removed from within a limit, which shall be prescribed by the county inspector at point of disembarkation, if infected with scab.

SEC. 12. Any inspector of sheep who shall fail to comply with any of the provisions of this act, or who shall willfully and knowingly give a false certificate in any case where he is required to give a certificate, or who shall willfully and with intent to harass, or put to expense any owner or person in charge of sheep notify said owner or person in charge, that his flock is diseased, or who shall willfully demand or receive any fee or compensation where none is allowed by law, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not less than one hundred nor more than two hundred dollars, and thereupon the office shall be deemed vacant, and the commissioners' court may appoint another inspector for such county.

SEC. 13. Any owner or person in charge of sheep who shall willfully and knowingly violate any of the provisions of this act, where the penalty is not otherwise provided by this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined not less than one hundred nor more than two hundred dollars.

SEC. 14. That all laws and parts of laws in conflict with this act, be and the same are hereby repealed.

SEC. 15. The present law upon the disease of scab being wholly insufficient for the protection of the wool growers of this State, and the necessity for a more efficient law upon the subject creates an imperative public necessity and an emergency that the constitutional rule requiring this bill to be read on three several days be suspended, and that this act take effect and be in force from and after its passage, and it is so enacted.

SEC. 16. The counties of Grayson, Freestone, Gonzales, Cooke, Bell, Coryell, Hamilton, Lampasas, Morris, Titus, Cass, Marion, and Bowie are hereby exempted from the operation of this law.

Approved, April 4, 1883.
Takes effect after passage

AN ACT to amend sections four and sixteen of an act entitled "An act for the protection of the wool-growing interests of the State of Texas," approved April four, eighteen hundred and eighty-three.

Be it enacted by the legislature of the State of Texas, That sections four and sixteen of an act entitled "An act for the protection of the wool-growing interest of the State of Texas," approved April four, eighteen hundred and eighty-three, be amended so they shall hereafter read as follows, to wit:

"SEC. 4. The inspector shall be entitled to receive the sum of two cents per head unless otherwise provided in this Act, for all sheep inspected under the provisions of this act: *Provided,* The inspector shall be entitled to only one cent per head for any number he may inspect for any one person in excess of two thousand head; in no one case shall his fees exceed one hundred dollars, such fees to be paid by the owner or person in charge of the sheep inspected: *Provided,* That when an inspector shall inspect any sheep and find no scab to exist in the flock inspected, then if he has inspected, on his own motion, he shall receive no fee, but if the inspection has been made at the instance of others, then the party making the request shall pay the fees: *And, provided further,* That the inspector shall have a lien for his fee upon all sheep inspected by him and found to be diseased with scab: *Also, provided,* That if any owner or person in charge of sheep affected with scab report in writing to the county inspector or his deputy, that his sheep are so affected and that he proposes to take means forthwith to cure the same, it shall not be lawful for the inspector to inspect such flock or receive any fees for the same within twenty days after said report: *Provided,* The inspector in such cases shall prescribe limits for said flock: *Provided,* That if after the expiration of the twenty days aforesaid, the inspector has received no notice in writing as hereinafter provided, from the party in charge of said flock, that he has thoroughly dipped his flock to cure the same as proposed, then the inspector shall be entitled to receive from such parties in charge of such sheep the same fee as though he had inspected said flock, and found the same diseased: *Provided further,* That no person shall be required to dip his ewe sheep if pregnant with lamb at any time within twenty days before or after lambing, but such person shall nevertheless be required to hold such sheep within the portion of county prescribed by the county inspector for such sheep to be held in during the time they are affected with scab.

"SEC. 16. The counties of Grayson, Freestone, Gonzales, Cooke, Morris, Titus, Cass, Marion, Bowie, Red River, Trinity, San Jacinto, Polk, Anderson, Van Zandt, Cameron, Collin, Colorado, Grimes, Houston, Webb, Encinal, Hunt, Hopkins, Rusk, Ellis, Dallas, Rockwall, Denton, and Fannin counties are hereby exempted from the operations of this law."

Approved, February 20, 1885.

STOCK LAWS.

AN ACT to amend section forty-six, chapter twenty-five, of the acts of eighteen hundred and eighty-five, entitled an act to amend chapter seventy-nine of the acts of eighteen hundred and eighty-three, entitled an act to amend chapter forty-eight of the acts of eighteen hundred and eighty-seven, an act to amend section forty-six of an act to encourage stock-raising and to protect stock-raisers, approved April twenty-two, eighteen hundred and seventy-nine, and amended April four, eighteen hundred and eighty-one, and April twelve, eighteen hundred and eighty, and March twenty-seven, eighteen hundred and eighty-seven.

Be it enacted by the legislature of the State of Texas, That section forty-six of the above-recited act shall hereafter read as follows: The counties of Anderson, Austin, Angelina, Bell, Bowie, Brazos, Bastrop, Bosque, Burleson, Brazoria, Caldwell, Camp, Calhoun, Cass, Chambers, Cherokee, Collin, Colorado, Cooke, Dallas, Delta, Denton-Ellis, Erath, Fannin, Franklin, Falls, Freestone, Gonzales, Eastland, Stephens, Fay, ette, Fort Bend, Galveston, Goliad, Grayson, Gregg, Grimes, Hardin, Harrison, Hays, Henderson, Hill, Hood, Hunt, Hopkins, Houston, Jackson, Jasper, Jefferson, Johnson, Kaufman, Lamar, Lee, Leon, Lampasas, McLennan, Madison, Marion, Montgomery, Montague, Morris, Nacogdoches, Newton, Orange, Panola, Parker, Polk, Palo Pinto, Rains, Red River, Robertson, Rockwall, Rusk, Sabine, San Augustine, San Jacinto, Shackelford, Shelby, Smith,Tarrant, Titus, Trinity, Tyler, Upshur, Van Zandt, Walker, Washington, Wharton, Wise, Wood, Jack, Harris, Chambers, Clay, Young, Wheeler, Lavaca, Nueces, Bee, Refugio, Limestone, San Patricio, Somervell, Matagorda, Victoria, Milam, Live Oak, Williamson, Brewster, Cameron, El Paso, Encinal, Duval, Clay, Presidio, Webb, Mills, Liberty, and Travis, to take effect after the next general election, are hereby exempt from the operations of this act, and that the provisions of the same shall in no wise relate or apply to the aforesaid counties: *Provided,* That in those counties bordering on the line of the State, except those bordering on Red River and the Rio Grande and the counties of Nueces and Cameron, whether organized or unorganized, the governor shall appoint an inspector, whose duty it shall be to inspect, under the provisions of this act, all stock about to be driven or shipped out of the State. Where there is a depot or place for the shipment of cattle, no inspector of hides and animals shall be elected, but one for each of such counties, except the counties of Nueces and Cameron, shall be appointed by the governor and confirmed by the Senate, who shall hold office for two years and until his successor shall be appointed and confirmed; said inspector so appointed to take the constitutional oath of office, and give the bond now required of inspectors of hides and animals, and such inspector shall receive the same fees now allowed to inspectors of hides and animals, and perform the same duties: *Provided*, That such cattle shall not be subject to inspection on board of any railroad unless the same have been placed on board of such train for the purpose of evading the provisions of this act: *And provided further*, That the counties of Limestone, Fayette, Lavaca, Gonzales, Colorado, Bell, Calhoun, Cameron, Duval, Encinal, Webb, Zapata, Starr, Hidalgo, Hays, Guadalupe, Caldwell, Blanco, Llano, Kendall, Comal, Houston, Austin, Jackson, Victoria, Freestone, Hamilton, Williamson, Milam, Live Oak, Harris, Bosque, Erath, Hood, Somervell, Liberty, and Fannin counties shall be exempt from all laws regulating inspection of hides.

SEC. 2. That the counties of Wichita, Wilbarger, Hardeman, Childress, Douley, Armstrong, Carson, Potter, Oldham, Hartley, Dallam, Gray, Hemphill, Roberts, Lipscomb, Calahan, Taylor, Nolan, Mitchell, Howard, Martin, and Karnes be placed under the operations of the inspection laws now in force and which may be in force under the provisions of this act.

SEC. 3. That the counties of Jones, Fisher, Scurry, Borden, Dawson, Grimes, Yoakum, Terry, Lynn, Garza, Kent, Stonewall, Haskell, Throckmorton, Baylor, Knox, King, Dickens, Crosby, Lubbock, Hockley, Cochran, Bailey, Lamb, Hall, Floyd, Motley, Cottle, Hale, Briscoe, Swisher, Castro, Parmer, Deaf Smith, Randall, Ochiltree, Hansford, Hutchinson, Moore, Sherman, Harris, Glasscock, and Liberty are hereby exempt from the operation of the stock law.

SEC. 4. The great necessity for this law creates an imperative public necessity and emergency requiring the constitutional rule that bills be read on three several days in each house be suspended, and the same is therefore suspended, and that this act take effect and be in force from and after its passage, and it is so enacted.

(NOTE.—The foregoing act originated in the House, and passed the same March 25, 1889; and passed the Senate March 25, 1889.)

Approved, March 29, 1889.

INSPECTION OF HIDES AND ANIMALS.

AN ACT to amend section one of an act entitled "An act to amend section forty-six, chapter twenty-five, of the acts of eighteen hundred and eighty-five, entitled an act to amend chapter seventy-nine of the acts of eighteen hundred and eighty-three, entitled an act to amend chapter forty-eight of the acts of eighteen hundred and eighty-seven, an act to amend section forty-six of an act to encourage stock-raising and to protect stock-raisers, approved April twenty-two, eighteen hundred and seventy-nine, and amended April four, eighteen hundred and eighty-one, and April twelve, eighteen hundred and eighty, and March twenty-seven, eighteen hundred and eighty-seven, and March twenty-nine, eighteen hundred and eighty-nine.

Be it enacted by the legislature of the State of Texas, That section forty-six of the above-entitled act shall hereafter read as follows: The counties of Anderson, Austin, Angelina, Bell, Bowie, Brazos, Bastrop, Bosque, Burleson, Brazoria, Caldwell, Camp, Calhoun, Cass, Chambers, Cherokee, Collin, Colorado, Cooke, Dallas, Delta, Denton, Ellis, Erath, Fannin, Franklin, Falls, Freestone, Gonzales, Eastland, Stephens, Fayette, Fort Bend, Galveston, Goliad, Grayson, Gregg, Grimes, Hardin, Harrison, Hays, Henderson, Hill, Hood, Hunt, Hopkins, Houston, Jackson, De Witt, Jasper, Jefferson, Johnson, Kaufman, Lamar, Lee, Leon, Lampasas, McLennan, Madison, Marion, Montgomery, Montague, Morris, Nacogdoches, Newton, Orange, Panola, Parker, Polk, Palo Pinto, Rains, Red River, Robertson, Rockwall, Rusk, Sabine, San Augustine, San Jacinto, Shackelford, Shelby, Smith, Tarrant, Titus, Trinity, Tyler, Upshur, Van Zandt, Walker, Washington, Wharton, Wise, Wood, Jack, Harris, Chambers, Clay, Young, Wheeler, Lavaca, Nueces, Bee, Refugio, Limestone, San Patricio, Somervell, Matagorda, Waller, Karnes, Victoria, Milam, Live Oak, Williamson, Miller, Liberty, Wichita, Wilbarger, Archer, Hardeman, Childress, Hall, Collingsworth, Donley, Gray, Armstrong, Briscoe, Floyd, Randall, Kendall, Comal, Travis, Navarro, Brown, Coryell, Hamilton, and Mills, are hereby exempt from the operation of this act; and that the provisions of the same shall in nowise relate or apply to the aforesaid counties: *Provided*, That in those counties bordering on the line of the State, except those bordering on Red River and the Rio Grande where there is a depot or place for the shipment of cattle, no inspector of hides and animals shall be elected, but one for each of such counties shall be appointed by the governor, who shall hold office for two years, and until his successor shall be appointed, and said inspector, so appointed, to take the constitutional oath of office and give the bond now required of inspectors of hides and animals, and such inspector shall receive the same fees now allowed to inspectors of hides and animals and perform the same duties: *Provided*, That such cattle shall not be subject to inspection on board of any railroad unless the same have been placed on board of such train for the purpose of evading the provisions of this act: *And provided further*, That the counties of Limestone, Fayette, Lavaca, Gonzales, Colorado, Bell, Calhoun, Hays, Guadalupe, Caldwell, Blanco, Llano, Kendall, Comal, Houston, Austin, Johnson, Hill, Ellis, Jackson, Victoria, De Witt, Freestone, Hamilton, Williamson, Milam, Live Oak, Harris, Bosque, Erath, Hood, Somervell, Liberty, Coryell, Lampasas, Mills, Wichita, Wilbarger, Hardeman, Childress, Hall, Collingsworth, Donley, Gray, Armstrong, Briscoe, Floyd, Randall, Kendall, Fannin, Camp, Delta, Franklin, Hopkins, Hunt, and Navarro shall be exempt from all laws regulating inspection of hides; that all laws and parts of laws in conflict with the provisions of this act are hereby repealed.

SEC. 2. The great necessity for this law creates an imperative public necessity and emergency, requiring that the constitutional rule that bills be read on three several days in each house be suspended, and the same is therefore suspended, and that this act take effect and be in force from and after its passage, and it is so enacted.

(NOTE.—The foregoing act originated in the house and passed the same by a vote of 78 yeas and no nays; and passed the Senate by a vote of 22 yeas and no nays.)

Approved, March 23, 1891,

ANIMALS—SALE OF.

AN ACT to provide for the punishment of persons furnishing, giving, or using any false pedigree or false certificate of sale.

Be it enacted by the legislature of the State of Texas, That any person who shall knowingly and willfully furnish or give to a purchaser of any animal any false pedigree or false certificate of sale of such animal, and every person who shall knowingly and willfully use, for the purpose of deceiving, any false pedigree or false certificate of sale of any animal, whether such false pedigree or false certificate of sale was furnished, given, or procured, in this State or elsewhere, shall, upon conviction thereof, be punished by a fine in any sum not less than twenty-five nor more than five hundred dollars, or be imprisoned in the county jail for a term not exceeding six months, or by both such fine and imprisonment.

SEC. 2. The near approach of the end of the session creates an imperative public necessity that the constitutional rule requiring bills to be read on three several days be suspended, and it is so enacted.

Approved, April 13, 1891.

WOOL GROWING—PROTECTION OF.

AN ACT for the protection of the wool-growing interests of the State of Texas, and to repeal chapter fifty-four of the acts of the eighteenth legislature, approved April four, eighteen hundred and eighty-three, and chapter fourteen of the acts of the nineteenth legislature, approved February twenty, eighteen hundred and eighty-five.

Be it enacted by the legislature of the State of Texas, That whenever it appears from the assessor's rolls of any county that there are as many as five hundred sheep owned and assessed for taxes in any county of this State, it shall be the duty of the commissioner's court of said county, upon the application of one or more resident owners of sheep of said county, to appoint an inspector of sheep, who shall be a resident citizen of such county, and well versed in the scab and diseases which usually affect sheep, and said inspector shall hold his office for two years, or until his successor is appointed and qualified. Said inspector may appoint one or more deputies, who shall likewise be well versed in scab and other diseases of sheep, who shall take the oath of office prescribed by the constitution, and may lawfully perform the same acts as the inspector of sheep, and the inspector may require of his deputies so appointed, bonds payable to himself for the faithful performance of their duty as such deputies.

SEC. 2. Said inspector of sheep shall, within twenty days after receiving notice of his appointment and before entering upon the duties of his office, execute a bond with two or more good and sufficient sureties, in a sum to be fixed by the commissioner's court, not less than one thousand nor more than five thousand dollars payable to the county judge and his successors in office, conditioned that he will faithfully and impartially discharge and perform all the duties incumbent upon him as inspector of sheep. Said bond shall be approved by the commissioner's court and be recorded in the office of the county clerk of the county as other official bonds.

SEC. 3. It shall be the duty of the inspector of sheep or his deputy to carefully and minutely examine and inspect at any time sheep in his county or which may be driven into or through his county and which he has reason to believe or is informed in writing by any one or more sheep-owners of his county or of any adjacent and contiguous county is affected with scab or any other infectious or contagious disease; and when one or more sheep affected with scab are found in any flock so inspected, the entire flock shall be condemned by said inspector or deputy and considered as affected with said disease.

SEC. 4. The inspector shall be entitled to receive the sum of two cents per head, unless otherwise provided in this act, for all sheep inspected and condemned under the provisions of this act: *Provided*, The inspector shall be entitled to receive only one cent per head for any number he may inspect for any one person in excess of two thousand head. In no one case shall his fee exceed fifty dollars; such fee to be paid by the owner or person in charge of the sheep so inspected and condemned: *Provided*, That when an inspector shall inspect any sheep and find no scab to exist in the flock of sheep so inspected, then the fees for such service shall be paid by the person at whose instance such inspection was made: *And provided further*, That the inspector shall have a lien upon all sheep so inspected and condemned by him for his fees as provided in this section: *Provided further*, That if any owner or person in charge of sheep affected with scab or other contagious disease shall report the same in writing to said inspector or his deputy, and that he proposes to take means forthwith to cure such disease, it shall not be lawful for the inspector to inspect such flock within twenty days after such report: *Provided*, That if after the expiration of the twenty days aforesaid the said sheep have not been thoroughly cured, then the said sheep shall be subject to inspection as hereinbefore provided.

SEC. 5. It shall be the duty of the inspector of sheep or his deputy to arrest and take in charge any flock or flocks of sheep, the property of owners who do not reside in his county, or have no certain or fixed ranch therein, found traveling through his county, and found after inspection to be affected with scab, and to hold and dip said sheep at the cost of the owner or person in charge of such flock or flocks until the same shall be cured; and said inspector shall be entitled to recover from the owner or person in charge of such flock or flocks of sheep so held by him the sum of two dollars per day as compensation for holding such sheep, in excess of inspection fees provided for in section four of this act; and said inspector shall have a lien upon all sheep so held by him until all fees and expenses for holding and dipping incurred by him are paid: *Provided*, That said inspector shall not in any case hold said flock or flocks of sheep exceeding twenty days.

SEC. 6. Whenever any flock of sheep in any county in this State has been inspected as provided for in this act and found to be affected with scab, it shall be the duty of the owner or person in charge of such flock to thoroughly cure the same within twenty days from said inspection.

SEC. 7. Any inspector of sheep or his deputy who shall fail to comply with any of the provisions of this act, or who shall willfully, or with intent to harass, vex, or put to expense any owner or person in charge of sheep, notify such owner or person in charge that his flock is diseased, or who shall unlawfully demand or receive any fee or compensation where none is allowed by law, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than fifty nor more than two hundred dollars, and thereupon the office shall be deemed vacant, and the commissioner's court may appoint another inspector for such county.

SEC. 8. Any owner or person in charge of sheep who shall willfully and knowingly violate any of the provisions of this act, when the penalty is not otherwise provided by this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than fifty nor more than two hundred dollars.

SEC. 9. Whenever in any county in this State there shall not be sufficient scab or other contagious and infectious diseases among the sheep to pay the sheep inspector a fair remuneration under the fees provided by this act, it shall be lawful for any association of wool-growers in such county to pay such inspector such additional sums of money as to them may seem right and proper in order to keep such inspector in the performance of the duties of his office.

SEC. 10. The counties of Grayson, Freestone, Gonzales, Morris, Titus, Cass, Marion, Bowie, Red River, Trinity, San Jacinto, Polk, Anderson, Van Zandt, Cameron, Collin, Colorado, Grimes, Houston, Webb, Encinal, Hunt, Hopkins, Ellis, Dallas, Rockwall, Denton, Fannin, Henderson, Brazos, Smith, Panola, Gregg, Lamar, Wood, Rains, Limestone, Cook, Brown, Comanche, Cherokee, Mills, Montgomery, Shelby, Lee, Burleson, Rusk, Lavaca, Milam, Wise, Upshur, Robertson, Camp, Parker, Franklin, Navarro, Karnes, Wilson, Atascosa, Harrison, San Augustine, Sabine, Fayette, Austin, Leon, Madison, Hill, Bosque, Waller, Fort Bend, Washington, Guadalupe, Caldwell, Hays, Tarrant, Johnson, Clay, Montague, Erath, Hood, Somervell, Bastrop, Harris, Harrison, Camp, Orange, Jefferson, Hardin, Liberty, Chambers, Newton, Tyler, Jasper, Kaufman, Nacogdoches, DeWitt, Victoria, Jackson, Calhoun, Refugio, Goliad, and Aransas counties are exempted from the provisions of this act.

SEC. 11. That chapter fifty-four of the acts of the eighteenth legislature, entitled "An act for the protection of the wool-growing interests of the State of Texas," approved

April fourth, eighteen hundred and eighty-three, and chapter fourteen of the acts of the nineteenth legislature, entitled "An act to amend sections four and sixteen of an act entitled 'An act for the protection of the wool-growing interests of the State of Texas,' approved April fourth, eighteen hundred and eighty-three," approved February twentieth, eighteen hundred and eighty-five, be, and the same are hereby, repealed.

SEC. 12. The fact that there is now no adequate protection to wool-growers against contagious diseases and the near approach of the close of this session creates an emergency and public necessity requiring that the constitutional rule requiring bills to be read on three several days in each house be suspended, and it is so suspended.

(NOTE.—The foregoing act was presented to the governor of Texas for his approval on the 8th day of April, A. D. 1891, but was not signed by him, nor returned to the house in which it originated with his objections thereto; nor were any objections thereto filed by him in this office after adjournment of the legislature, within the time prescribed by the constitution. This act thereupon became a law without his signature.—Geo. W. Smith, secretary of state.)

LIVE STOCK—PROTECTION OF.

AN ACT to prevent the spread of glanders and farcy among horses and other live stock in this State, and to provide a penalty for driving, riding, or leading any animal infected with such diseases along or across any public highway in this State knowing them to be so infected, or permit such to run at large.

Be it enacted by the legislature of the State of Texas, That if at any time it shall come to the knowledge of any county judge of any county in this State, by affidavit of any credible citizen of his county, stating that affiant has reason to believe and does believe that glanders or farcy exists among any horses, mules, jacks, or jennets in said county, naming owner or owners of such animal or animals so infected if known, if unknown so stating, it shall be the duty of such county judge, upon the filing of said affidavit, to immediately appoint three disinterested and intelligent citizens of said county, whose duty it shall be to carefully and minutely examine said animal or animals so reported to be diseased with glanders or farcy; said three citizens before entering upon the duties required of them by this act shall take an oath before some officer legally qualified to administer oaths that they will discharge their duties as prescribed by this act in a fair and impartial manner.

SEC. 2. If, after carefully and minutely examining the animal or animals so reported to be affected with glanders or farcy, said three citizens shall be of the opinion that the animal or animals so examined by them are diseased with glanders or farcy, they shall condemn the same, and it shall be their duty to appraise such animal or animals at their just and full value at the time of such examination and condemnation, and shall forthwith report their act in writing to the county judge, giving in said report the number of animals condemned, if any, the owner or owners of same if known, and if unknown so stating it, with the appraised value of same. But if the said citizens have any reasonable doubt as to the diseased animals being affected with glanders or farcy, before condemning as above provided for they shall require the owner or owners to have said diseased animals separated from contact with all other animals subject to contagion for a reasonable time, and when they are fully satisfied that the disease is glanders or farcy then they shall proceed to condemn and destroy said animals as provided for in this section.

SEC. 3. The county judge, upon the recipt of the report named in section two of this act, shall issue his order to the sheriff or any constable of his county commanding him to seize said diseased animal or animals and take same to some secluded place and kill them and bury or burn the carcass.

SEC. 4. After the said diseased animal or animals are killed as provided in section three of this act, it shall be the duty of the county clerk, upon the written order of the county judge, to issue a warrant or warrants of the county, payable out of the general revenue, in favor of the owner or owners of said animal or animals so killed, for the amount of the value, as diseased, if the animal has any value, as appraised by said citizens who examined and condemned the same. The sheriff or constable killing, burning, or burying said animal or animals shall be paid by the county such sum as the commissioners' court thereof may determine their services worth.

SEC. 5. Any person who may drive, lead, or ride any animal infected with said disease or glanders or farcy, knowing them to be so infected, on, along, or across any public highway in this State, or allow any such animal so diseased (knowing them to be so diseased and owning such animal) to run at large on the open range of any county in this State, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than ten dollars nor more than two hundred dollars.

SEC. 6. This act does not repeal any law now in force for the prevention of glanders or farcy, but is cumulative thereto.

SEC. 7. Whereas there is now no existing law to protect the live stock of this State from the spread of the diseases of glanders and farcy, an imperative public necessity and emergency exists requiring that the constitutional rule requiring bills to be read on three several days in each house be suspended, and it is hereby suspended.

Approved, April 12, 1892.

VERMONT.

AN ACT in amendment of section four thousand and nineteen of the revised laws, relating to the preservation of domestic animals.

It is hereby enacted by the general assembly of the State of Vermont, Section four thousand and nineteen of the revised laws is hereby amended so as to read as follows, viz:

"Such commissioners may prohibit the introduction of horses known as bronchos or other horses, or of any cattle or other domestic animals believed to be infected with or exposed to any contagious disease into this State, or may quarantine all such animals for such time as said commissioners may deem necessary or that the public good requires, but may not prohibit the transportation of the same in cars through this State. A person who shall violate such order of said commissioners after the same shall have been published for three successive days in such newspapers published in this State as the commissioners may direct shall pay to the treasurer of the State a fine of not more than three hundred dollars for every offense, and every officer or agent of any company or other person who shall violate such order shall be subject to the fine aforesaid. In case of the introduction into this State at the same time of a number of horses known as bronchos or other horses, or of cattle or other domestic animals, contrary to the orders of said commissioners, the introduction of each animal shall be deemed a separate and distinct offense."

Approved, November 27, 1888.

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